TELEPHONE ENGINEER

Vol. VII CHICAGO, MAY, 1912 No. 5

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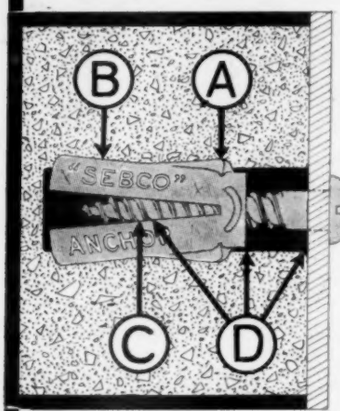

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"MONOPOLY" OR "UNITY?"

NATURAL monopoly has been the slogan for years of those telephone interests which, by reason of earlier establishment, would gain by monopolization. The origin of the phrase is generally attributed to the Bell faction, because there it has been put to the most consistent use. Of course there are instances where independent operating companies have manifested ambition to drive a competitor out of business and appropriate the local field; that it was never done in the name of monopoly, natural or otherwise. Indeed, the unofficial slogan of the independents has always been competition, and much energy has been expended in trying to prove that dual service, far from being a nuisance, is actually desirable. City telephone directories have been checked through to show that the duplication of service never exceeds fifteen per cent, and then the fifteen per cent have been interviewed for expressions on the convenience of having two telephones.

In spite of those honest efforts, in spite of the excellence of their motives, the fact remains that no household public utility, whether gas, water, electricity, Yaryan heat or the telephone, has any excuse or reason for a dual service. If the independents made a mistake in advocating such service, they have wisely discontinued the practice.

But the biggest mistake the Bell interests have made is in insisting on natural monopoly. And they are still pursuing that course.

The American public hates the word monopoly. The almost universal protest of the press against the Dick patent decision of the United States Supreme Court last month was occasioned not by the nature of the opinion, nor because it conveyed any new power to patentees, but because it brought home to the layman a sense of the absolute dictatorship of monopoly. It is the word itself, nothing more, that is in bad repute. Our efficiency is judged by our service; but our intent is judged by our words. The subject is slightly psychological, but a working knowledge of practical psychology makes splendid equipment for the department of public relations. Witness the selection of the names "Home" and "Citizens" for independent telephone companies. The psychological value was unconscious, perhaps; but the result was extraordinary. No "monopoly" could ever gain so many friends while it called itself by that name. The big independent movement itself was inspired by hatred of the word.

It is not our purpose to suggest a substitute for "monopoly." It has no direct synonym; but there are ways of expressing the idea without offending

the *amour propré* of the people. Leave the expression "natural monopoly" to the philosophers and economists, who are not commercial.

TELEPHONE DEPRECIATION.

ON another page we present an abstract of a paper on depreciation, a subject always interesting and concerning which, in the telephone field, no student's opinion should be ignored. In this connection we think it advisable to reprint the schedule of average depreciation of telephone materials prepared by E. L. Cline and presented before an independent association meeting at South Bend, Ind.:

Equipment.	Years Life.	Per cent Depreciation.	Per cent Salvage Value.
Conduit	Unknown	1.0	0
Underground cable	25	2.4	40
Underground lateral	20	3.0	40
Aerial cable	15	4.0	40
Poles, cedar, 25 ft.	10	9.0	10
Poles, cedar, 30 ft.	12	7.08	15
Poles, cedar, 35 ft.	15	5.33	20
Poles, cedar, 40 ft.	17	4.7	20
Poles, cedar, 45 ft.	19	4.21	20
Poles, cedar, 50 ft.	19	4.21	20
Poles, chestnut, 25 ft.	8	11.25	10
Poles, chestnut, 30 ft.	10	8.5	15
Poles, chestnut, 35 ft.	12	6.7	20
Poles, chestnut, 40 ft.	13	6.1	20
Poles, chestnut, 45 ft.	15	5.3	20
Poles, chestnut, 50 ft.	15	5.3	20
Cross arms	8	12.5	0
Copper wire	15	2.0	70
Iron wire	10	10.0	0
Cable terminals	12	8.33	0
Telephones	10	9.0	10
Switchboard	10	8.0	20
Private branch exchanges	10	8.0	20
Buildings	50	2.0	0
Insulators	15	3.33	50
Insulated wire (iron)	12	7.5	10
Insulated wire (copper)	12	6.6	20
Messenger	12	8.3	0
Telephone instruments	10	7.0	30
Booths	10	8.0	20

In further consideration of the value of whatever information has been gathered on this subject, we present here the conclusions of the special committee on depreciation of the National Independent Telephone Association, Messrs. W. Roy McCanne, Charles E. Tarte and Gansey R. Johnston:

We are convinced that there is an inevitable wear and decay of a large part, if not all, of every telephone plant which cannot be met by current repairs, but which sooner or later must be met by substantially complete replacement.

The exposures of every telephone plant are such that there is a risk of damage from fire and storm which can not be covered by insurance.

The relations of telephone companies to municipal and other authorities and property owners are such that expensive changes in plant form and location are from time to time required.

The degree of physical deterioration, and the measure of risk from casualty and compulsory changes, cannot be determined with any close approach to accuracy. We estimate that taking independent telephone plants as they come, and assuming a good standard of construction in form, material and workmanship, a fair degree of development within the plant area, and that regard for current maintenance which is needful to insure good service, the physical deterioration may be measured by an annual percentage of plant cost (without interest) seldom going below three or rising above eight.

The risks of casualty and change should be measured separately. These will rarely average, with ordinary care in placement and protection (assuming the current insurance of exchange buildings and contents against fire) above an annual percentage of two. This is known to be five to ten times the burden upon some long-established plants.

For our purpose, we may assume that other risks of the business find compensation in the profits, or in the appreciation of the intangible assets or the market value of the property or securities.

We recommend that each telephone company make as careful an estimate as can be made of the state of the various components of its plant in respect to deterioration, and estimate the probable average life of such parts and their salvage value. By this process a schedule of probable replacement costs may be prepared. This schedule can be studied in the light of the company's resources. If these resources permit, deductions should be made from the income yearly or monthly on a uniform scale preparatory to meeting the extraordinary expenses. An investment for the purpose should be made in some form which can be realized upon in the time of need, whether in the company's own plant, its own securities, or outside marketable securities. The latter affords an extra safeguard. If the company has reasonable expectation of yearly increases in its current resources, it may properly provide for replacement through the medium of an ascending scale of deducting from income. If the company has an insufficient income to meet its schedule, it should nevertheless record regularly its shortage from the schedule, as measuring the inadequacy of its income (as through too-low rates or small proportion of productive property) or excess of expenditure.

In the form of accounting, we prefer regular monthly charges against income. Against the accumulation of such charges should be charged the cost when made of replacements designed to be caused thereby. We recommend that there be built up in this reserve, on a sinking fund principle, allowance for certain estimated liabilities destined to occur at a definite time, as the replacement of large switchboards and pole leads; but that even such reserves be not separated from the general reserve nor be too strictly defined.

While the depreciation allowances should be established upon the basis of detail study, we deem it better policy to treat them in the accounts upon a broad foundation for the property as a whole, than to set them aside specifically for the separate component parts of the plant.

We recommend that proper care be given to writing off the Cost of Plant, the value of the expired or abandoned portions of the plant not replaced, and of other deductions from plant value.

The recommendations herein made are not radical. They call for a proper classification on the current statements of the disbursements made, or needful at a future time, in furnishing the service, keeping up the plant, and providing for its preservation. If previous operations, no matter what accounting has been followed, have provided for the maintenance costs, there will be no diminution in the sums properly available for distribution to the owners. Unless a reserve is created from income against which to charge the cost of heavy renewals, changes or losses as incurred, either excessive charges must be made against income through a short period, or the plant cost must be overstated. Sooner or later, such costs are inevitable, and provision should be made out of the earnings of the property during its use to replace it when it becomes unfit for further use. To do less is to fail to preserve the integrity of the property and the business. To do more is to state incorrectly the cost of furnishing the service. "Yet better the excess than the defect."

It is not long since many telephone men refused to recognize depreciation at all, or to set aside any fund to provide for it. Today many are willing, but ignorant of the proper method. Under commission control depreciation funds will be as definite as interest on investment, and an accurate knowledge of the subject will be demanded.

WIRELESS AND THE TITANIC.

IN THE investigation following the terrible marine disaster of last month, when the White Star liner "Titanic" went down with some 1,500 passengers on board, it is reported that the wireless blundered; that some of those lives might have been saved by a more efficient use of the space signals. Perhaps that is true. Perhaps if those who received the call of Operator Phillips had had his spirit of self sacrifice more might have been accomplished.

But look back. The transatlantic liners of a few years ago were nearly as big as the Titanic. Icebergs were no smaller than they are now. And a ship in

the predicament of the Titanic would have been utterly without hope of communicating her distress to any human being outside the meager range of vision. Her cockle-shell life-boats would have drifted in the icy sea until they capsized or their passengers succumbed to exposure. We must believe that, without the blessing of wireless, her human cargo would have been totally lost, without a survivor to explain the cataclysm.

And so we cannot but feel that the gratitude of nations must extend to those men who have so developed the sensitive detectors of waves that radiate through space that we can use them in daily intercourse across chasms that nothing else will bridge. We hope and are confident that no such calamity as the sinking of the Titanic will ever again be visited upon a civilized nation. But if there still be such danger, in years to come, it is only to the wireless telegraph and its ultimate successor, the wireless telephone, that we may look for assurance that help is near and all are safe.

TEN THOUSAND DOLLAR MEN.

ONE day recently Thomas A. Edison was deploring the lack of ten thousand dollar men. He declared that a New York friend of his had been looking for two such men and could not find them. "There were plenty of twos and threes," said Mr. Edison, "but no tens."

George W. Perkins took up the subject and declared that the great reason for the situation is "the natural one."

"No one is more competent to know the dearth of $10,000 men than Mr. Edison," declared Mr. Perkins. "The human mind has been emancipated from the body.

"Electricity has given wings to the human mind, and it is the mind, not the body, that does the business.

"As late as 1810 the shortest possible length of time required for mind in the United States to communicate with a mind in Europe was between fifty and sixty days. Today's mind on the Pacific coast can communicate with a mind in Japan through the air almost instantly.

"In the past few years the men who have been making their way to high-salary work have been making these tremendous strides almost unprepared. It has come too fast, so that when they have reached the $10,000 point they have gone up the line and have rarely been found—in the vernacular—out of a job.

"The other night I was at a dinner with five other business men. In a short space of time Mr. A was called to the telephone three times. It developed that in that time a business deal had been consummated. His call was from Chicago, the man with whom he had the direct dealing. The Chicago man, in turn, had to consult with a man in St. Paul and one in Denver. The second was to put the result of these communications with St. Paul and Denver to Mr. A. The third call formed the final decision in the deal.

"These changes have come fast. So the $10,000 man must be everlastingly alert as to every move on the business chessboard. Competition is overwhelming and his responsibility according.

"The big men of today are those who have gone through every phase of experience in the business in which they are engaged. They are drawn from all conditions of men. There is a great interchange of thought and the big men are only those who welcome this. To think is the thing.

"Education is a great factor in growth, but business brains are not built entirely from books, but hard experience and ability to keep the mind machinery in march with man-made machinery.

"The $10,000 man must be honest. The day has come when to be honest means not technically, legally honest, but broadly, humanely honest—honest in thought, in purpose, in act.

"As to business itself and its evils, at least two things must be done—business must give up its improper, harmful practices and the law must readjust itself to modern economic conditions."

In the telephone field, as in every other big, industry today, there are many ten thousand dollar jobs waiting to be filled. The fact that they are not filled but shows the opportunity open to the young telephone men who can qualify. To qualify means, perhaps, the sacrifice of many a pet hobby or habit, means hard work and careful development of the best there is in you. But isn't it worth trying for?

GERMANY'S TELEPHONE LINES.

CONSUL GENERAL FRANK. D. HILL, Frankfort on Main, says telephone lines in Germany are now owned and operated by the government; the telephone service belongs to the post-office and the telephone lines are operated by the imperial postal authorities, except in Bavaria and Wurttemberg, which have maintained their separate postal services.

There were in 1908 (latest figures available) 33,441 cities and towns in the German Empire having telephone service. There is no minimum size limit below which localities are shut out from telephone service. Exchanges are put up whenever it appears desirable, without regard to the size of the town. New exchanges are not, however, installed within a radius of 3.1 miles of existing exchanges. There are no towns of importance which have not telephone connections.

The rapid growth of the German telephone service is shown by the following table prepared for this office by the imperial post-office at Frankfort on Main, showing the number of subscribers and the number of conversations held in 1905 and 1910:

Cities—	Number of subscribers		Number of conversations	
	1905	1910	1905	1910
Berlin	74,836	122,558	211,014,664	304,018,946
*Charlottenburg	8,927	20,317	21,647,316	49,090,044
*Rixdorf	1,561	3,816	4,480,908	10,178,822
*Wilmersdorf	2,981	13,436	9,257,853	27,380,702
Hamburg	36,278	57,554	112,634,866	120,332,656
Leipzig	13,159	22,913	22,873,829	43,559,164
Dresden	12,917	19,892	24,049,721	36,946,557
Cologne	11,163	19,062	25,294,988	33,159,931
Breslau	9,364	15,208	24,311,046	31,140,069
Frankfort	14,104	22,838	39,485,420	42,973,923
Dusseldorf	7,149	13,551	17,284,679	26,820,618
Hanover	7,184	12,231	13,486,954	21,800,202
Essen	3,638	8,194	13,070,400	22,537,258
Chemnitz	4,952	8,193	11,691,485	21,049,515
Magdeburg	5,333	8,085	18,470,034	21,741,098
Bremen	5,325	9,021	15,367,810	20,108,964
Mannheim	4,825	8,491	11,920,118	19,364,042

*Suburb of Berlin.

The total number of subscribers in the German Empire, including Bavaria and Wurttemberg, was 591,973 in 1905, and 1,040,849 in 1910. The number of conversations in 1905 was 1,207,446,753 and 1,664,662,-

521 in 1910. It will be observed that the number of subscribers has increased more rapidly than the number of conversations.

The subscription rate varies according to the number of subscribers. In towns having not over 50 subscribers the annual rate is $19.04. It increases gradually to $42.84 for cities having over 20,000 subscribers. The charge for the use of public pay stations is 2.4 cents for a conversation of three minutes. Long-distance tolls range from 4.8 cents for a distance of 15.5 miles or less, up to 48 cents for over 621 miles, for a three-minute conversation.

Telephone equipment is delivered by private firms. The principal German concerns manufacturing purely telephone equipment are located at Berlin, Hanover, Munich, Hamburg, Fuerstenberg, Osterode, etc. The electrical industry is one of Germany's greatest industries. Equipment varies in different exchanges. A great variety of switchboard systems are in use, depending largely on the needs of the exchanges.

A HOT AIR TELEPHONE.

A SIMPLE way of making telephone conversations more audible has been invented by Herr Peterson, a bank manager of Nykjobing, Denmark. Claiming the principle that sound is more readily transmitted through rarefied air, he has constructed an apparatus to warm the transmitter, whereby the air in it becomes thinner and the sound is intensified. Prof. Hannover of the Danish government telephone testing station, who has made extensive experiments with Peterson's apparatus, says in his report that the increase in sound obtained is remarkable. Telephone conversations between Copenhagen and Nykjobing, a distance of some seventy-five miles, could be clearly followed some distance away from the instrument.

No doubt the excellent Herr Peterson is quite sincere in his claims; and doubtless, too, he has really invented something, since this is attested to by no less an authority than Prof. Hannover. When we went to school, some years ago, rarefied air conducted sound with great reluctance. One had only to withdraw most of the air from the vicinity of a bell to render it absolutely inaudible to the human ear, even though the vibrations of its sides were so violent as to be visible to the eye. Most of our readers will recall the familiar laboratory experiment with an air pump, a receiver and a bell, as illustrated in all good works on physics.

So we must conclude that Herr Peterson either has reversed a law of nature, upon which achievement he is surely to be congratulated; or he is getting results without understanding the cause, in which case it would be well for him to investigate before entering extensively into the preparation of patent specifications.

CITY COUNCIL CAN FIX RATES.

Judge Duncan, of the Common Pleas Court, has rendered a decision holding that the city council has the right to fix telephone rates. The Tiffin (Ohio) council recently passed such an ordinance, and when the Tiffin Art Metal Company refused to pay the old rate the Tiffin Consolidated Telephone Company threatened to remove the telephone. Suit was brought to restrain the telephone company from doing so, and the Court granted the injunction.

A Lot of Loaded Lines

This Applies to the Other Fellow.

Some people, when they telephone,
Are rude as they can be.
As friends I surely would disown
Some people when they telephone,
They speak in such a savage tone
And lose all courtesy.
Some people, when they telephone,
Are rude as they can be.

The World's Greatest Telephone Publication has published many an editorial on Telephone Courtesy; but we hand it to the Marseilles, Ill., *Plaindealer* for brevity and neatness.

For heaven's sake act as if you had a little fetchin' up when you use the telephone.

The orientals are quick to adopt occidental improvements; but they never conform their habits to the traditions of the apparatus. When we were very young we thought China was an up-side-down country, where people walked on the ceiling of an inverted world and read backwards. Now we find that the peak load in San Francisco's chinatown telephone exchange comes at eleven o'clock at night; and that when there is any excitement, like the killing of a Tong member, the switchboard goes dead. Fiction has nothing on fact.

HAVE YOUR COMPANY WIRE YOU A PACKAGE OF SEEDS.

[From the Albert Lea, Minn., *Enterprise.*]

The Western Electric Telephone Company at Mason City, has been making a thorough test of seed corn in all localities of that section of Iowa.

It is one of life's little irritations, says E. W. B., to have the Missus purchase an electric flatiron to connect to the telephone, the house not being wired for lighting. Look on the bright side, E. W.: suppose she had connected the telephone to an electric light circuit?

THE BLESSINGS OF THE TELEPHONE.

[From the Reidsville, Ga., *Journal.*]

The good citizens to the north of Manassas have built them a mutual telephone line that runs through the Hodges and Calloway communities and serves quite a number of other families. Recently Mr. Sigh Holland's little grandson, Jimmie, who lives near, and being the only one near his home, discovered a negro in the fowl house stealing chickens in broad open daylight, whereupon he telephoned his grandfather, who told him to shoot the thief in the leg. The report of the gun quickly followed and the negro hollered, "Oh, Lord!" and run. Rural telephones are a great blessing, and we are glad to see the line from Manassas almost in Reidsville.

PROBABLY BY ATTENDING CONVENTIONS.

Sir: I read in the Buffalo *Times* that "fifty-eight per cent of total conversations are over the telephone." How did they get the dope on the other forty-two per cent?—M. K. L.

MICE IN THE OPERATING ROOM?

[From the Waupun, Wis., *Democrat.*]

The telephone girls were not forgotten at Christmas, the Paramount Company presenting each girl with several pair of hose.

THESE ARE RATHER FAR-FETCHED.

President Oliver Lash of the Sewickley Telephone Company, West Newton, Pa., is doing a driving business.

Director Adam Glass insulates with the Home Telephone Company of Montgomery, Ala.

Secretary-Treasurer W. L. Shoots of the Home Telephone Company, Elkhart, Ind., doesn't hunt for trouble.

Vice-President Scott Skinner of the Creston (Iowa) Mutual Telephone Company is handy when making connections.

Leroy Yeast is director of that rising enterprise, the Macomb (Ill.) Telephone Company.

Line upon line, line upon line.—*Isaiah* xxvii:10.

P. H. W.

How the Wisconsin Commission Works

By J. N. Cadby *

THERE has long been some need of regulating public utility companies; first of all, because in general they are not competing companies but monopolies, and there must therefore be some method other than through competition of regulating the rates and quality of service. The points of view from which this need may be examined are numerous. The question may be considered from the view-point of the consumer or the public, from the point of view of the investor, the operator, the promoter or the municipality. The consumer is interested in getting a high grade of service at as low a rate as he can. He often overlooks the importance of the quality of service furnished, if he can see a reduction in the rate. The investor objects to the changing of political conditions in the community from time to time, and the difficulties encountered in trying to get franchises or perhaps in collecting for service rendered to the municipality; and therefore he welcomes a regulating board that is far enough away from the local situation to size up the case in a less partial manner than is possible with a group of men whose constituents in the various sections of the city are urging them to take certain steps which may not in their own opinion be necessary or advisable, but who with their limited facilities for investigating the proposition, or because of the pressure which is brought upon them, have to take action which is not always advantageous to the various parties concerned. The operator is able to get the necessary equipment to furnish adequate service and to satisfy the consumers when he is ordered by the governing board, whatever it may be called, to bring the service up to definite requirements. It is often difficult for him to persuade the investor that certain changes are necessary, without the assistance of a disinterested party such as a governing board to point out the need of keeping the service up to definite requirements.

The promoter, or the man who wishes to start a new concern, if he is the type of promoter who wishes to make great gain for himself, will find that the governing board is in his way. I believe he is the only man who loses when there is a governing board similar to the Railroad Commission of Wisconsin. In my judgment, the public, the investor, the operator and the municipality all gain by regulation of the sort we have in Wisconsin.

It is often thought that the Railroad Commission establishes all these requirements and makes necessary all the extra work which is placed upon those who have to make reports, but in reality the commission is simply administering the law. The law on the statute books provides that the commission shall do certain things, in some cases prescribing the manner in which they shall do them, but in all cases pointing out the lines along which investigation and rulings must be made. The function of the commission, then, is simply to administer the law as it stands on the statute books.

In Wisconsin the Railroad Commisison regulates railways (whether they be steam or electric), waterworks, gas plants, electric light plants, telephone companies, express companies and toll bridges. It matters not whether these are owned by individuals, by corporations or by municipalities; they all fall under absolutely the same requirements. The municipal plants must live up to just the same requirements as the privately owned plants. Those owned locally must live up to just the same requirements as those owned by Wall street.

One of the provisions of the public utilities law is that before a new plant shall start up, where there is one existing, the organizers must receive from the commisison a certificate of convenience and necessity. Before such a certificate is granted by the commission, a public hearing is held, to which interested parties are invited. The announcements are made public through the press and otherwise, and the local authorities are all notified as well as representatives of the plant already operating. If there is one street railway in a city, a second one cannot be started without

FORM 625

JOINT ENGINEERING DEP'T WIS. TAX & R. R. COMMS.

Telephone Service Inspection

City ..... Name of Co. ..... Date ..... Insp. .....

	Party Called		Time to Ans.		Time of Test	Call Made From
	Number	Name	By Cent.	By Party		
1						
2						
3						
4						
5						
6						
7						
8						

(Always call R. R. stations) (over)

Wisconsin Telephone Inspector's Report Card.

going through a public hearing and having a thorough examination made into the conditions by the commission; and at this public hearing the municipality and the company already operating are heard.

Another feature of the public utilities law in Wisconsin is that of the indeterminate permit in place of the old franchise. At first the companies were allowed to come under this feature of the law by turning in their franchises and taking in place of them indeterminate permits. Later the time was extended during which they would be allowed to exchange their franchises for the indeterminate permits, and the last legislature placed all of the public utilities under this feature of the law; so that now all public utility companies are operating under indeterminate permits instead of under franchises. Thus franchises do not expire at the end of a given period, and the city can at any time vote to take over the plant. A valuation of the property is made by the Railroad Commission, at which the plant must be taken over, giving a fair return to the operating company. There have been cases in other states at other times when the public

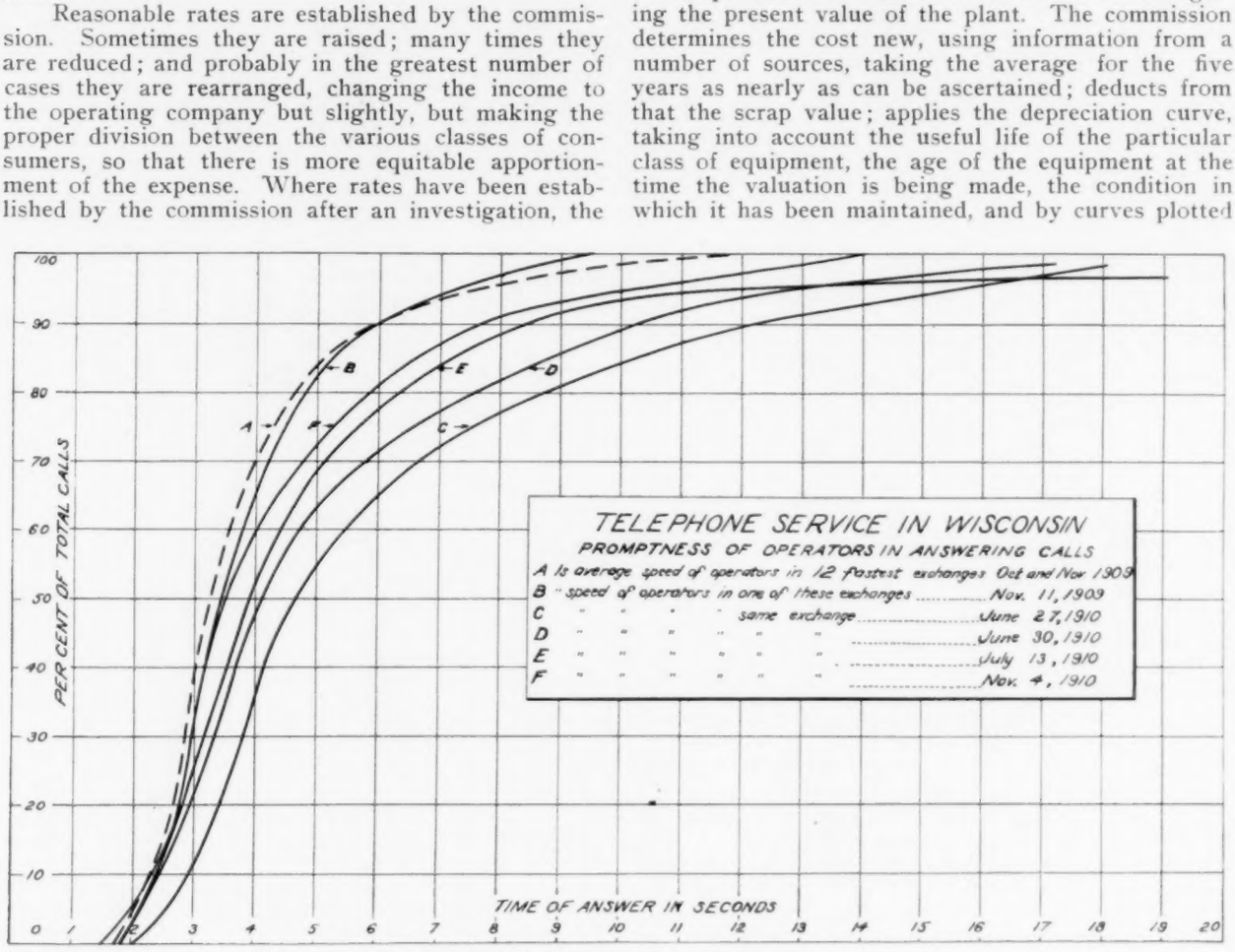
*Abstract of a paper read before the Iowa independent telephone convention. Mr. Cadby is inspector of telephone and electrical service for the Wisconsin Railroad Commission.

utility company at the expiration of the franchise period practically lost its property, with almost no compensation. There is no opportunity for such action under the present laws of Wisconsin.

Another feature of the law is the regulation of stock and bond issues. This allows the investor to be protected. The stock and bond issues represent real value, and there is no chance for watering the stock.

Reasonable rates are established by the commission. Sometimes they are raised; many times they are reduced; and probably in the greatest number of cases they are rearranged, changing the income to the operating company but slightly, but making the proper division between the various classes of consumers, so that there is more equitable apportionment of the expense. Where rates have been established by the commission after an investigation, the and bond issues or for rate making, the law requires that all the physical property be valued, and that it be apportioned between the various uses for which it is maintained. For instance, a company operating both railway and lighting must be valued, and an apportionment made between that part used and useful for the railway and that part used and useful for the lighting.

Depreciation is taken into account in investigating the present value of the plant. The commission determines the cost new, using information from a number of sources, taking the average for the five years as nearly as can be ascertained; deducts from that the scrap value; applies the depreciation curve, taking into account the useful life of the particular class of equipment, the age of the equipment at the time the valuation is being made, the condition in which it has been maintained, and by curves plotted



Service Efficiency Curves for a Typical Exchange.

increase in business has been, in practically all cases, considerably greater than before, showing that the scientific rates, worked out in the manner they are handled by the commission, stimulate new business.

Adequate service must be furnished. That means a good deal, and takes into account a large number of features. There is also need of safety of construction and operation, which comes in for a share of attention. Railroads are required to stop or to make proper connections at junction points with other roads, and the matter of physical connection between Bell and independent telephone companies, for instance, is now up in the La Crosse case. I think that will be made a test case and be carried up to the Supreme Court to see whether that feature of the law will stand.

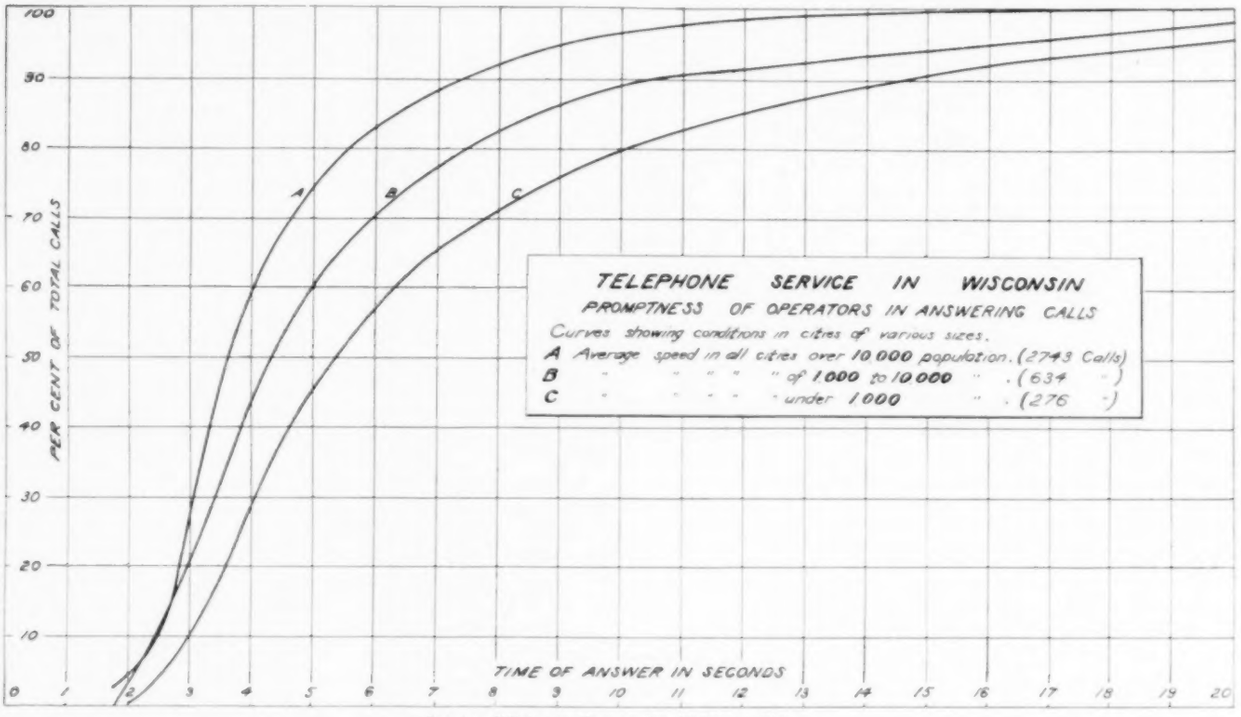
In connection with the valuation of physical property, whether it be for condemnation, for stock up on the compound interest basis they determine the present condition of the equipment, adds on the scrap value and determines the present value of the entire property. To this present physical value is added 10 or 12 per cent for engineering and contingencies—interest during construction, when the plant is earning nothing, the cost of organization and legal expenses, and such matters as that which are really expenditures in building up the property before it becomes an earning property.

When the profit upon the plant has been low, it becomes necessary to take into account the going value at the time of the valuation. If a property has been paying good dividends, then a rate could be made upon the physical property which would be fair and just; but since in building up a new business it usually takes considerable time to get it to a point where it pays, it is necessary to take into account the

profits which have not been paid out of the business, which really should have come in the way of interest, depreciation, etc. When losses have been incurred in order to keep the plant running during this early period, there should be compensation for this amount. That is taken into account by the commission in building up the figure which they call the going value of the concern. This will be higher than the present value, and may be either higher or lower than the cost new. The plant is allowed to earn, in addition to interest upon its physical property or upon its going value, taxes, interest, insurance and operating expenses. There probably are cases where bad investments have been made or where poor management makes it impossible to maintain a rate and at the same time build up the business or even continue in business at all. If very poor investments have been made, or there has been poor management, it might require such a high rate that it would discourage consumers entirely. So each case must be treated separately, and the past history of the plant must be taken into account in determining the proper rates.

Under safety of operation and adequacy of service the commission takes up a large number of matters. One is that of rail service—adequate stations and regular train service. Another is block signals and interlocking plants. They do not allow a block signal system or interlocking plant to be put in commission until it has been tested out and approved by members of the commission staff. All wrecks are investigated, cases of broken rails or wheels looked into, regular track inspection is being carried on, every fatal accident is reported to the commission and investigation made, grade crossings are being eliminated as rapidly as possible, and electric lines crossing railroads, public highways or foreign circuits are guarded.

In all the work of regulating service the supervision of the work is all that is attempted by the commission. They do not attempt to get out and find all of the bad places on a system, but encourage self-criticism on the part of the utility companies, and simply make these checks to determine the thoroughness with which the operating companies are carrying on their work. The spotter element does not enter in as much as one might think. The spotter who is so much hated by the railroad man is some one they never meet face to face; they seldom have a chance to be heard regarding his reports. If the spotter reports a thing, that is the end of it. In the case of the commission the inspector does not announce himself before he arrives, because that would necessitate in practically any organization, a little difference in the quality of service rendered. One cannot do just the same when he knows he is being examined as he would if he did not know. Therefore the inspectors go into a place unannounced and start their tests. Before they leave, however, they show the records that they have taken to the proper authorities of the operating company, and take up with them the various matters. If the conditions are abnormal and can be explained, that explanation is noted upon the record, which is later sent in to the office. From the office a report is sent to the company, and if they do not reply, stating that necessary changes have been made or are about to be made, then the matter is followed up again; and if repeated letters do not bring about the necessary requirements, the company is required to appear before the commission in a public hearing and show cause why the commission should not proceed to enforce these requirements.


TELEPHONE SERVICE IN WISCONSIN
PROMPTNESS OF OPERATORS IN ANSWERING CALLS
Curves showing conditions in cities of various sizes.
A Average speed in all cities over 10,000 population. (2743 Calls)
B " " " " of 1000 to 10000 " . (634 ")
C " " " " under 1000 " . (276 ")
PER CENT OF TOTAL CALLS
TIME OF ANSWER IN SECONDS
100
90
80
70
60
50
40
30
20
10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Service Efficiency Curves for Different Cities.

Fig. 1 shows the sort of telephone test cards that each inspector carries around in his pocket. Every time he has occasion to call up the express office to know whether his trunk has come, or to call up the depot to find out when his train will leave, he records the number and name of the party he is calling, the time required by the operator to answer, the time required to get his party, and how often there is supervision in case the party does not answer promptly. Also they note how long it takes to report that the line is busy, the giving of a wrong number, when such is the case, and the time of day and telephone from which the call is made. This allows the matter to be followed up to see whose fault it is or what the particular operating conditions were at the time of the test.

These test calls are made from house to house without being announced beforehand. The inspector who does this work has to be rather ingenious; he must manufacture conversation without getting himself into trouble; he must ask the grocer, the butcher and baker and a lot of other people a lot of questions which will not make the operator or the party called or the party whose telephone he is borrowing suspect that a test is being carried on. This would mean abnormal conditions; not necessarily because they want to have things look better, but because human beings couldn't help doing things a little differently if they knew the inspector was checking up on that particular day. On the back of the card there is room for more complete remarks, if the inspector notes anything that needs further attention; if he is not able to hear properly, if the receiver is broken or out of order, or he notices anything else which needs attention, all this information is reported and the company is notified promptly about it. An inspector can make about a hundred test calls of this sort, calling only about twice from each telephone, unless he gets in jail. Every once in a while an inspector is taken by some person whose telephone he is using to be a suspicious looking character who wants to find out the lay of the land, so as to notify the rest of his gang and come in and rob the house that night. In several cases it has taken the detective forces of the cities a good many hours to run down our man, because he shifts around from one part of the town to another and is sometimes rather difficult to catch. They have been locked up two or three times, however.

From these test cards we plot up the speed of the operator in answering. That seems to be the best measure of the service. Of course it is not the only factor, as you know, which goes to make up adequate telephone service; the speed in connecting, accuracy, and other factors, such as supervision and maintenance enter into it; but we find that if the operators are answering promptly they are usually giving the right number and supervising properly. We have more trouble when they are not busy enough or too busy than when they are able to answer promptly.

The commission has not formulated any exact rule regarding the time which will be allowed to answer calls, or the percentage of calls which must be answered within a given time. However, for the larger exchanges we expect that 85 per cent of the calls will be answered in five seconds or less, that very few wrong numbers will be given, and that the supervision and transmission will be satisfactory. We also take up such matters as the number of parties on a line, the quality of the equipment, whether there are enough positions on the board and enough operators during the different periods. The whole subject is studied to some extent in each case. The commission also encourages tests by the company representatives, whether they employ the observation board of either portable or stationary type, or whether the solicitors and other employes or officers in going about making the calls; then we compare with them on results.

Fig. 2 is a tabulation of the results obtained the first time the larger exchanges were visited. At the present time we regularly inspect forty-five of the larger exchanges. In addition to the regular inspection of 100 test calls we inspect wherever there is a complaint, no matter whether it be large or small, and we follow up the conditions in the places where we find poor service. A careful examination of this table, if we had the time to devote to it, would show that the rank of those various exchanges, when taken on the basis of promptness of the operators in answering, would be very much the same as upon the other bases. It is interesting to note that of the four faster exchanges in the state two were Bell and two independent. I think the slowest were one of each also. There is no difference in the requirements for privately owned corporation or municipal plants.

Figure 3 shows some data plotted off in a cumulative curve, which indicate the percentage of calls answered in any given time. Following up the second line you will find that curve *C*—the lowest curve, which represents the condition in one city—had only 46 per cent of the calls answered in five seconds or less. Curve *A* had 74. Curve *B* is the average of all the tests made in October and November of 1909, when the first survey of conditions in the state was made.

Figure 2 shows a curve sheet in one particular exchange. Curve *A* was the average of the twelve fastest exchanges in the state for those two months that I have just mentioned. This particular exchange was one of those twelve. Its condition is shown by Curve *B*. You can take five or ten or eight or twelve, or any number of seconds and find the percentage of calls that were answered during that period. First, they had sleet storms, then a shortage of operators; another time they had inadequate switchboard capacity and they had a strike. They had their ups and downs, as is shown by some of these curves. In this particular city there was formerly two exchanges, the bell and the independent. Shortly after the commission went into office the Bell Company bought out the independent company and the two exchanges were combined, going through the general stages: first, a connection between the two exchanges, and then finally the combining of the two into one, eliminating one exchange and operating entirely from the Bell exchange. That, together with the other items which I mentioned, caused the low curves. I can report that probably 84 to 88 per cent of the calls are now answered in five seconds or less with practically every call answered within nine or ten seconds.

Considerable expense is incurred in carrying out all the different lines of work which the commission is doing. There are nearly one hundred people in the employ of the commission, some for full time and

some for only part time. Many of the men at the University are serving the commission a part of their time, or at irregular intervals when they are needed. There are the legal, statistical and accounting groups, the valuation group, the safety service group for block signal interlocking plants, and then the service inspection group, who are checking up gas, electric, telephone, water and railway service. The commission has quite a laboratory and quite a library, and we co-operate with engineering societies and societies of various kinds, and with other commissions and governing bodies. Of course a great deal depends upon the commissioners themselves. They are given a great amount of power. A body of men who did not wish to conduct their part of the work as it should be conducted would under this arrangement be able to do a great deal of damage. The commission in Wisconsin are eliminating the unnecessary duplication; they are educating the public by explaining technical points; they act as a board of arbitrators in various cases; they give legal consulting advice to small companies and small municipalities, where such is necessary, and they see that the stocks and bonds issued represent real value. They are working toward the establishment of reasonable rates and adequate service. The conditions are not perfect, and the work is not being done as well as we would like to see it, when we get right down to the fine points, but we think it is a step in the right direction, and that conditions are very much better now than they were before the commission went into office.

Gasoline and the Telephone

For local troubles the motorcycle has proven a great success with one company, which is now operating nearly 6,000 telephones on three exchanges within the city limits, in charge of one trouble man, says J. T. Carliss in the *Western Pennsylvania Independent Telephone News*. No troubles reported before 4:30 p. m., are held over until the next day. The man assigned to this work also cleans and repairs the motorcycle and keeps it in good running order. There are days, of course, during the spring and fall months that a motorcycle cannot be operated to advantage as there are times when even the brick pavement is unfit for an ordinary bicycle. However, our experience has taught us that a motorcycle can be used from seven to nine months of the year to a great advantage. For a number of years we were obliged to depend entirely on street cars, which on different lines in this city run on a ten and fifteen minute schedule, and which, of course, is a great loss of time in waiting, then after reaching the district, the trouble man would have anywhere from one to a dozen squares to walk to get to the exact location as called for on his trouble report. With the motorcycle it is much different, while the man would ordinarily be waiting for a street car he is at the exact location. Another item must be considered is the fact that the trouble man has nothing to carry and practically no walking to do, his repair grip, which is loaded with all kinds of parts for repairs, is set into a box on the luggage carrier and strapped in with one strap, it being only the work of a few seconds to release it.

It can readily be seen that it is possible for a good man to clear twice the amount of troubles in a day, as he has practically no lost time in waiting, no lost energy in walking a dozen of squares and carrying a repair grip weighing anywhere from twenty to twenty-five pounds.

The cost of maintaining a motorcycle if properly handled and cared for will not amount to any more in dollars and cents than street car fares to cover the same amount of territory, and the effort made by the company in clearing troubles with quick despatch is very pleasing to the subscriber.

The use of the automobile on toll lines and rural troubles is a boon to the telephone industry.

We all know that toll lines are subject to all kinds of trouble any hour of the day or night and possible miles away from the exchange, and we also know that it is impossible to catch a train to a near point at all hours, therefore by having an automobile housed in close proximity to the exchange "your train" is always waiting for you, instead of you waiting for a train. Another benefit to be derived from this source is that no relay of conveyances is required as is the case in going to the nearest point on the train and then having to drive a number of miles to your trouble, which, of course, all consumes time, and time lost in clearing toll line troubles is money lost in toll revenue merely for the lack of facilities, and which also results in a number of dissatisfied toll users.

A good, intelligent and careful lineman is selected for this class of work, and can become a proficient driver and mechanician within thirty days.

To show you what a good lineman with an assistant can do with this sort of a conveyance after a storm, I will recite one case. One morning last June two men left this office at 7:15 a. m., with reports for fourteen cases of rural and toll line trouble, and returned at 11:50 a. m., with the report that they had cleared all the trouble, each case has been O. K'd by the wire chief and an examination of the speedometer disclosed the fact that they had driven 41 miles. Without the automobile this amount of trouble would have required three livery rigs and three men, and would have consumed the greater part of the day.

For general use, such as looking up prospective subscribers in the outskirts of the city and rural districts, collecting from pay stations, etc., it is a great time saver. This company operates and maintains about one hundred and thirty pay stations in the city which heretofore took several days each month to collect. Now with the aid of the automobile the same work is accomplished in half the time.

Another item of interest is the fact that an automobile can be operated the year round. The machine shown in the accompanying cut is a Cadillac "30" roadster and has been in service for this company for the past eighteen months, has covered over twelve thousand miles over all kinds of roads and is still giving good service.

The cost of maintaining an automobile is not in the end any cheaper than livery hire, but it is a wonderful time saver and is of great benefit to the company's patrons, as it is conducive to a continuous service.

Captain Scott's Telephone Line

The narrative of Captain Robert F. Scott's expedition in search of the South Pole, which recently appeared in the *New York Times*, contains an interesting reference to the construction of a fifteen-mile telephone line. This line was used to connect one of the stations with Hut Point and was found very useful in reporting the movements of parties, pending changes in weather.

New York Commission News

The New York Public Service Commission, Second District, has received a complaint from Amos Van Etten, of Kingston, stating that the New York Telephone Company made a contract to furnish telephone service in his residence at a rate of $2 a month, but that in December, 1911, the company presented to him a contract providing for a rate of $2.50 a month, which he declined to sign, and that a threat was made to disconnect telephone service at his residence, but was stopped by an injunction. The petition alleges that there is no necessity for an increased rate in the city of Kingston, that the service can be furnished without any loss or injury to the telephone company at a less rate, and the commission is asked to investigate the rates in that city and determine what is a reasonable and fair charge. The complaint has been served upon the telephone company and an answer required.

The commission has received an informal complaint from the Postal Telegraph Company directed against the New York Telephone Company, alleging that the latter company is wrongfully and by illegal discrimination diverting to the Western Union Telegraph Company telegrams which are intended for the Postal Telegraph Cable Company. A large number of instances occurring at New York, Rochester, Poughkeepsie, Schenectady, Ithaca, Brooklyn, North Tonawanda, Albany and Gloversville are given.

Superintendent Kimmey of the Postal Telegraph Company calls attention to the fact that notwithstanding the matter was called to the attention of he New York Telephone Company on February 13 to March 1, President Bethel of the New York Telephone Company replied that it was not the intention of his company to permit any difference in treatment between calls for Postal offices and calls for Western Union offices and that every effort had been made to avoid any discrimination in this respect, but that the objectionable practice continues. The commission is asked to direct the telephone company to discontinue this practice and to instruct its operators that when a person on the telephone wishes to send a telegram the operator shall ask which telegraph company is desired.

Telephone Statistics of Canada

The statistical section of the Department of Railways and Canals, Ottawa, Canada, has just issued the first report of its kind dealing with the extent and character of telephone operations in the dominion. The object was to obtain information which would fairly and comprehensively show the facts with regard to organization, capital invested, operating income, operating expenses, equipment, tolls and employes.

It is pointed out by the Canadian *Electrical News* that complete information has not been obtained. On account of this being the first attempt to classify telephone information in Canada more than average difficulty was met with in obtaining the information sought for. Many of the companies are so small and have so little system in connection with their operations that the questions asked by the government could not be answered at all. The report does not claim to be complete, though it is evident from the figures given that it cannot be so very far from the facts. The total number of telephone organizations, which includes companies of all kinds, is given as 537. Of these, Ontario contributes 319, Quebec 32, New Brunswick 16, Nova Scotia 14, Alberta 4, Saskatchewan 143, Manitoba 3, British Columbia 5, Prince Edward Island 1. The discrepancy is doubtless greater in Ontario than in any other province where there are now actually about 450 independent companies operating.

It is pointed out that the three provinces of Manitoba, Alberta and Saskatchewan have, through their governments, to a greater or less degree taken over the telephone interests. In Alberta and Manitoba, practically all the separate companies which existed a few years ago have been merged under government control. In Saskatchewan the process of absorption is under way, but there remained on June 30, 1911, still 142 companies operating on an independent basis.

Under the heading "Capital and Cost," the total liabilities reported amount to a little over $40,000,000. The total number of telephones in use is 302,759, which works out to a little more than $132 per telephone.

The gross earnings of all the Canadian companies reported, amounted to a little over $10,000,000; operating expenses almost $7,000,000, leaving net earnings of slightly over $3,000,000. These gross earnings average $33.25 per telephone or $14.64 per mile of wire. Operating expenses averaged $23.05 per telephone or $10.15 per mile of wire. The equipment of all the companys' lines includes 687,728 miles of wire; of this, 576,712 is urban, and 111,015 rural. The long distance wire mileage is reported as 94,750. Of the total of 302,759 telephones in use, 174,994 are operated by central energy and 127,765 by magneto.

The total number of employes reported was 10,425, who received $915,636 per year. This amount equals 13.1 per cent of the total operating expenses, which would seem to indicate that the proportion of labor involved in the cost of operating a telephone system is relatively low. It is pointed out, however, that many of the rural organizations do not employ either operators or repairers, the connections being made often by some person who received therefor the free use of a telephone.

The report prints the data received from the 537 companies, giving for each the head office address, capital stock, funded debt, property and equipment cost, revenue, operating expenses equipment, wires (whether galvanized or copper and whether overhead underground or submarine), the number of telephones of each type, and the number of employes with their remuneration.

Summing up, the report concludes: "That returns were received from 537 distinct telephone organizations must be regarded as encouraging, in view of the many obstacles which had to be overcome in gathering data for this first report. The notice to reporting officers was insufficient and there was not time enough for the carrying on of complete explanatory correspondence. The work done, however, has been educational in character and has undoubtedly paved the way for smoothness and a larger measure of success in future."

Consular Agent W. L. Faber, Funchal, says the recently installed public telephone service of Madeira is a government monopoly conducted on the same lines as in Portugal. The system will be confined to the charge for each installation is to be 6 milreis ($6) and the annual charge 15 milreis ($15). When the number of subscribers reaches 300 this yearly charge will be reduced to 13 milreis ($13).

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

HARRY GOSS WEBSTER started in the telephone business as general utility man at Kalamazoo, Michigan, when he was eighteen, and for the following twelve years served the Bell licensee companies operating in Michigan and Minnesota, in various capacities, including those of trouble man, switchboard repair man, installer, general inspector, exchange manager, and engineer.

He entered the independent telephone field in the spring of 1900, taking up engineering work for the Stromberg-Carlson Telephone Manufacturing Company at Chicago. During the year following he had charge of switchboard installations for that company at various points in Wisconsin, Iowa, Ohio, Georgia, New York, North Carolina, New Jersey and Massachusetts. During this active switchboard installation period he invented the two-wire multiple switchboard system known as the "differential relay" system which was adopted as a standard by the Stromberg-Carlson Company. The first switchboard of this type was installed under Mr. Webster's direction at Gloversville, New York, in 1901, and was the first metallic circuit system ever used, providing double supervision and employing but two wires in the multiple, with no ground at the substation.

An Engineering Specialist and Expert.

Harry G. Webster was a member of the engineering staff of the Kellogg Switchboard & Supply Company during the year following July 1, 1901, making many inventions in the common battery development of that company, some of which have continued as standards up to the present time. Following the change in stock control of the Kellogg Switchboard & Supply Company, he returned to the service of the Stromberg-Carlson Company in July, 1902; and for a considerable period had charge of the concern's engineering work, making numerous important inventions. Among these may be mentioned the differential induction-coil substation circuit, which is the present standard of the Stromberg company.

Mr. Webster's first experience as an expert witness occurred at this time, when he gave expert testimony on behalf of the Independent Telephone Company of Nashville, Tennessee, in what was probably the first physical-connection case on record.

About the time the Stromberg company was preparing to move to Rochester, New York, in the fall of 1903, Milo G. Kellogg was planning to re-enter the telephone field. Mr. Kellogg secured the services of Mr. Webster as the first of the corps of experts who subsequently made many early developments in automatic and semi-automatic telephony of great importance to the industry. Mr. Webster remained associated with Mr. Kellogg up to the time of the termination of the suit involving the stock control of the Kellogg Switchboard & Supply Company, early in 1909, following which he joined the staff of that company as an engineering expert.

In the spring of 1911, Mr. Webster left the Kellogg company to open his own office in Chicago as an engineering specialist and expert in patent matters.

Mr. Webster has been identified as expert witness, or consulting expert, with practically all important litigation involving telephone patents occurring since 1902. Among the infringement suits with which he has been associated may be mentioned. Western Electric Co. vs. Rochester Telephone Co., busy test; Western Electric Co. vs. Rochester Telephone Co., supervisory signals; Western Electric Co. vs. Galesburg Home Telephone Co., supervisory signals; Western Electric Co. vs. Akron Peoples Telephone Company, supervisory signals; Western Electric Co. vs. Zanesville Telephone Co., line signal control; Western Electric Co. vs. Dean Electric Co., party line key; Western Electric Co. vs. Sterling Electric Co., busy test; Kellogg Switchboard & Supply Co. vs. Dean Electric Co., harmonic ringing; Kellogg Switchboard & Supply Co. vs. Dean Electric Co., relay; Kellogg Switchboard & Supply Co. vs. Dean Electric Co., transmitter (the three preceding cases still pending); Parshall vs. Kinlock Telephone Co., harmonic ringing; Western Electric Co. vs. Kinlock Telephone Co., automatic ringing; A. S. Hibbard vs. Kinloch Telephone Co., automatic ringing; Western Electric Co. vs. Kinloch Telephone Co., O'Connell ringing key.

In the three suits last mentioned, Mr. Webster, acting as principal expert, discovered an unexpected reference, and by the construction and introduction in court of a working model of the system of the reference

contributed largely to the successful defense of these suits.

In addition to the infringement suits above mentioned, Mr. Webster has taken an active part in the prosecution of many vigorously contested interference proceedings before the Patent Office, and has filed upwards of one hundred patent applications covering improvements of his own invention. Many of these improvements have gone into general commercial use.

Mr. Webster has been actively engaged as an expert in patent matters, to an extent probably unequaled during the past ten years by any one else in the telephone engineering field; and his twenty-four years' practical experience covering all phases of the telephone art has kept him in touch with all of its various stages of development. This broad experience in telephony has been supplemented by much special work along other lines, such as fire-alarm signaling, time service, block signaling, enameled wire manufacture, oscillograph records, gas-engine ignition, automobile starting and lighting, and electrical testing generally. All of which goes to show that men who are wanting much to do can usually find it in the telephone industry.

H. G. Webster has been too active for diversions beyond his home and his work, but he has been known to play at golf and read the baseball scores when the Chicago teams are in the first division. He was born in Jackson, Michigan, October 28, 1870.

The A. I. E. E. Code of Professional Conduct

While the following principles express, generally, the engineer's relations to client, employer, the public, and the engineering fraternity, it is not presumed that they define all of the engineer's duties and obligations.

A. GENERAL PRINCIPLES.

1. In all of his relations the engineer should be guided by the highest principles of honor.

2. It is the duty of the engineer to satisfy himself to the best of his ability that the enterprises with which he becomes identified are of legitimate character. If after becoming associated with an enterprise he finds it to be of questionable character, he should sever his connection with it as soon as practicable.

B. THE ENGINEER'S RELATION TO CLIENT OR EMPLOYER.

3. The engineer should consider the protection of a client's or employer's interests his first professional obligation, and therefore should avoid every act contrary to this duty. If any other considerations, such as professional obligations or restrictions, interfere with his meeting the legitimate expectation of a client or employer, the engineer should inform him of the situation.

4. An engineer can not honorably accept compensation, financial or otherwise, from more than one interested party, without the consent of all parties. The engineer, whether consulting, designing, installing or operating, must not accept commissions, directly or indirectly, from parties dealing with his client or employer.

5. An engineer called upon to decide on the use of inventions, apparatus, or anything in which he has a financial interest, should make his status in the matter clearly understood before engagement.

6. An engineer in independent practice may be employed by more than one party, when the interests of the several parties do not conflict; and it should be understood that he is not expected to devote his entire time to the work of one, but is free to carry out other engagements. A consulting engineer permanently retained by a party should notify others of this affiliation before entering into relations with them, if, in his opinion, the interests might conflict.

7. An engineer should consider it his duty to make every effort to remedy dangerous defects in apparatus or structures or dangerous conditions of operation, and should bring these to the attention of his client or employer.

C. OWNERSHIP OF ENGINEERING RECORDS AND DATA.

8. It is desirable that an engineer undertaking for others work in connection with which he may make improvements, inventions, plans, designs, or other records, should enter into an agreement regarding their ownership.

9. If an engineer uses information which is not common knowledge or public property, but which he obtains from a client or employer; the results in the form of plans, designs, or other records, should not be regarded as his property, but the property of his client or employer.

10. If an engineer uses only his own knowledge, or information which by prior publication, or otherwise, is public property and obtains no engineering data from a client or employer, except performance specifications or routine information; then in the absence of an agreement to the contrary the results in the form of inventions, plans, designs, or other records, should be regarded as the property of the engineer, and the client or employer should be entitled to their use only in the case for which the engineer was retained.

11. All work and results accomplished by the engineer in the form of inventions, plans, designs, or other records, that are outside of the field of engineering for which a client or employer has retained him, should be regarded as the engineer's property unless there is an agreement to the contrary.

12. When an engineer or manufacturer builds apparatus from designs supplied to him by a customer, the designs remain the property of the customer and should not be duplicated by the engineer or manufacturer for others without express permission. When the engineer or manufacturer and a customer jointly work out designs and plans or develop inventions a clear understanding should be reached before the beginning of the work regarding the respective rights of ownership in any inventions, designs, or matters of similar character, that may result.

13. Any engineering data or information which an engineer obtains from his client or employer, or which he creates as a result of such information, must be considered confidential by the engineer; and while he is justified in using such data or information in his own practice as forming part of his professional experience, its publication without express permission is improper.

14. Designs, data, records and notes made by an employe and referring exclusively to his employer's work, should be regarded as his employer's property.

15. A customer, in buying apparatus, does not acquire any right in its design, but only the use of the apparatus purchased. A client does not acquire any right to the plans made by a consulting engineer except for the specific case for which they were made.

D. THE ENGINEER'S RELATIONS TO THE PUBLIC.

16. The engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, to extend the general knowledge of engineering, and to discourage the appearance of untrue, unfair or exaggerated statements on engineering subjects in the press or elsewhere, especially if these statements may lead to, or are made for the purpose of, inducing the public to participate in unworthy enterprises.

17. Technical discussions and criticisms of engineering subjects should not be conducted in the public press, but before engineering societies, or in the technical press.

18. It is desirable that first publication concerning inventions or other engineering advances should not be made through the public press, but before engineering societies or through technical publications.

19. It is unprofessional to give an opinion on a subject without being fully informed as to all the facts relating thereto and as to the purposes for which the information is asked. The opinion should contain a full statement of the conditions under which it applies.

E. THE ENGINEER'S RELATIONS TO THE ENGINEERING FRATERNITY.

20. The engineer should take an interest in and assist his follow engineers by exchange of general information and experience, by instruction and similar aid, through the engineering societies or by other means. He should endeavor to protect all reputable engineers from misrepresentation.

21. The engineer should take care that credit for engineering work is attributed to those who, so far as his knowledge of the matter goes, are the real authors of such work.

22. An engineer in responsible charge of work should not permit non-technical persons to overrule his engineering judgments on purely engineering grounds.

F. AMENDMENTS.

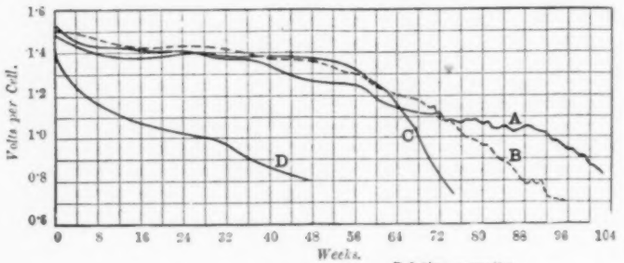
Additions to, or modifications in, this Code may be made by the Board of Directors under the procedure applying to a by-law.

A Comparison of Dry Cell Tests

By S. W. Melsom *

EVERY consumer of primary batteries—dry or wet—who buys in large enough quantities issues a specification of his own, the essential feature of which is usually its originality. Frequently not only the results required, but even the method of manufacture, is specified, and it is therefore eminently desirable that some standard simple test should be devised, which could be adopted by all users of primary cells. For the purposes of the tests described, four well-known makes of cell were used, four of each being selected at random from a batch of 60 supplied by the manufacturers. For obvious reasons the cells are designated in the tests as A, B, C. and D. It is noteworthy that, whereas in nearly every test cells A, B and C showed good and tolerably uniform results, cells D (which were stated to have quite a good reputation) fell below what ought to be the performance of an ordinary dry battery. This fact alone indicates the importance of making proper tests.

Owing to the absence of agreement as to the method of testing likely to give the best results, it was felt desirable, before settling on a definite test for use



Cells.	Watt hours.	Relative capacity. Watt hours.
A	43	100
B	40	93
C	35·5	83
D	12	28

Fig. 1.—Discharge for 5 Minutes Per Hour Through a Resistance of 50 Ohms Per Cell. Curves of Voltage on Closed Circuit.

in the Laboratory, to make a comparison between results obtained with a number of the tests in general use and those obtained by a test the conditions of which approximated as nearly as possible to actual working conditions. The cells subjected to the various tests were selected not in order to ascertain which type of cell is the best when taken into practical use, but with a view to determining the most suitable method of testing dry cells. The four types chosen for the purpose of the investigation were therefore those which previous tests had indicated as possessing widely different characteristics.

The size of cell employed was that most generally used for telephone work in this country, the dimensions over all being 7 in. by 2½ in. by 2½ in. Sixty cells of the requisite size of each of the four types were kindly made and supplied by the manufacturers, and four cells of each make were selected at random for each of the discharges mentioned. It was evident from the close agreement between the individual cells in each group that this number could be taken as fairly representative of the type. The four makes of cells are designated on the curves and in the tables A, B, C and D respectively.

The following series of tests were taken as being representative of those in general use:

Test 1, Fig. 1, represents as nearly as possible the working conditions of a cell on a telephone circuit. The information on which this test is based was kindly supplied by the National Telephone Company, *i. e.*, two cells working on a circuit the resistance of which is about 100 ohms, and the average discharge five minutes per hour. Measurements were made by the National Telephone Company and it was found that the minimum current with which a telephone microphone would work was 0.018 ampere, and the discharge of the cells was, therefore, considered to be completed when the voltage had fallen to 0.9 volt at the end of any period of discharge.

Test 2 was a discharge for five minutes per hour through a resistance of 1 ohm.

Test 3 was specified by the National Telephone Company, the cells in this case being discharged continuously for six hours per day through a resistance of 5 ohms, resting the other 18 hours. The discharge in this case was considered to be complete when the voltage of each cell taken after the period of rest had fallen to 0.9 volt, when discharged for two minutes through a resistance of 50 ohms. Fig. 2 shows the results for one cell (B).

Test 4 was the test formerly specified by the British Post Office. Each cell was discharged continuously

TABLE I.—RELATIVE CAPACITY OF THE CELLS AT VARIOUS RATES OF DISCHARGE.

No.	*(The Values Are in Watt-Hours, Except Where Otherwise Stated.)*	Cells A.	B.	C.	D.
1.	5 mins. an hour on 50 ohms	100	93	83	28
2.	5 mins. an hour on 1 ohm. Initial				
	After 6 months' storage	100	58	50	..
	After 12 months' storage	100	53	42	..
3.	6 hours per day on 5 ohms—				
	Mean of V. B. and V. E. curves	100	50	50	35
4.	Continuous at 20 milliamperes—				
	Initial ampere-hours	100	43	36	30
	Initial watt-hours	100	45	40	29
	After 8 months' storage, watt-hours	100	50	45	5
5.	Continuous on 10 ohms—				
	Initial to 0·7 volt	100	75	53	60
	Initial to 0·5 volt	100	76	55	60
	After 6 months' storage, to 0·7 volt	100	59	44	28
	After 12 months' storage	100	67	50	2
6.	Continuous on 100 ohms	100	68	51	35
7.	Continuous on 500 ohms—				
	To 1·3 volt	100	102	87	10
	To end, *i. e.*, 118 weeks	100	94	..	..

TABLE II.—RELATION BETWEEN INCIDENCE OF DISCHARGE AND CAPACITY. *(The Capacity in Each Case Is Given in Watt-Hours.)*

Test No.	Cells A.	B.	C.	D.
1.	43	40	36	12
2.	44	26	19	3
3.	126	63	63	46
4.	105	47	42	31
5.	64	49	35	38
6.	107	73	55	38
7.	70	66	..	..

at a constant current (in this case 20 milliamperes) until the E. M. F., observed immediately after the current was switched off, had fallen to one volt.

Test 5 (Fig. 3) favored by manufacturers, each cell being discharged continuously through a resistance of 10 ohms. This test is largely used, but the various

*Abstract of a Paper read before the Faraday Society.

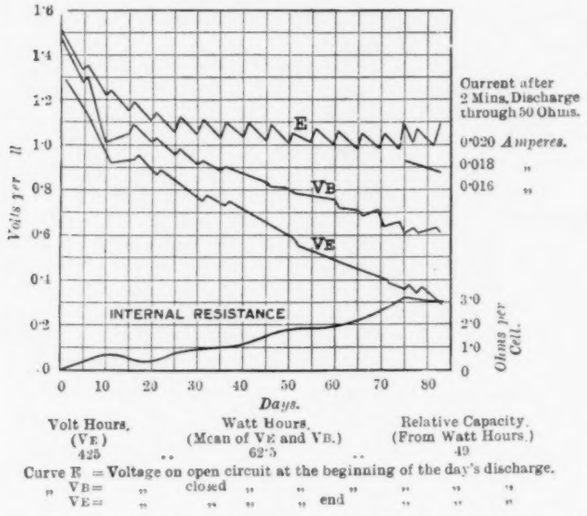
users are seldom agreed as to the point at which the discharge should be considered complete. Three complete discharges were made under these conditions; one immediately after the cells were received, one after six months' storage, and another after the cells had been stored for twelve months.

Test 6. In this case each cell was discharged through a resistance of 100 ohms, the discharge being considered to be complete when the voltage had fallen to 0.9 volt per cell.

Test 7 is one of the tests used by the British War Office, and consists in observing the voltage of the cell when it is discharged continuously through a resistance of 500 ohms.

Fig. 4 shows the case of 10 cells of each make stored in a cupboard, observations being taken from time to time of the open-circuit voltage.

Results of the Tests.—The volt-hours, ampere-hours, and watt-hours given by each cell (the result in each case being the mean of four cells) and, in addition, the relative value of each set of cells, taking for



Volt Hours. (VE)	Watt Hours. (Mean of VE and VB.)	Relative Capacity. (From Watt Hours.)
425	62·5	49

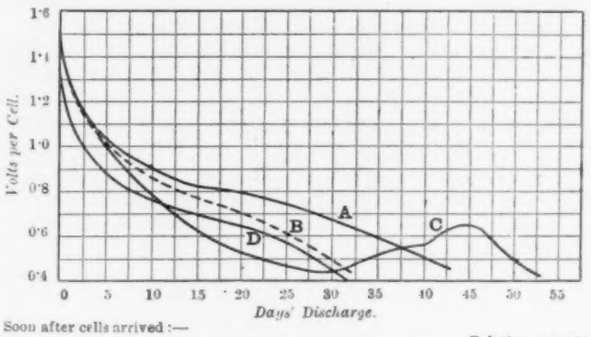
Curve E = Voltage on open circuit at the beginning of the day's discharge.
" VB = " closed " " " " " " "
" VE = " " " " end " " " "

Fig. 2.—Test 3. Discharge 6 Hours Per Day Through a Resistance of 5 Ohms. Cell B.

this purpose the output of cells A as 100, are given on the curves. A summary of the relative values is given in Table I. It will be seen that the order of merit was the same throughout, but the relative capacity varied considerably. The reason for this is apparently due to different methods of manufacture.

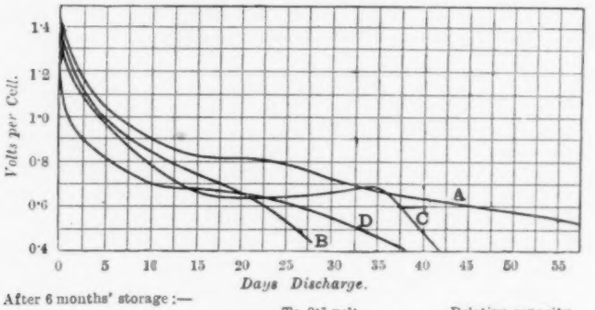
Capacity at Various Rates of Discharge.—In order to determine accurately the capacity of dry cells at various rates of discharge, it would be necessary to fix upon a point at which the discharge should be considered to be complete, at each of the various rates. This point should, of course, be based upon the relation of the fall in voltage to the current which is drawn from the cells. In the present work the limit was, in most cases, that specified by the various users of cells. Therefore, the summary of the results, given in Table II., must be taken only as an approximation. The differences are, however, in some cases so large that the effect of stopping the discharge at a slightly higher or lower point on the curve would not seriously affect them. For the purpose of this comparison we might dismiss cells D, that type being so different from the others, especially in its keeping properties. On the intermittent discharge (No. 1) all the cells gave a lower capacity than when discharged continuously at about the same current; this result is remarkable, inasmuch as the cells A, B and C, tested by the continuous discharges, showed little or no deterioration after twelve months' storage.

Conclusions.—In view of the great difference be-



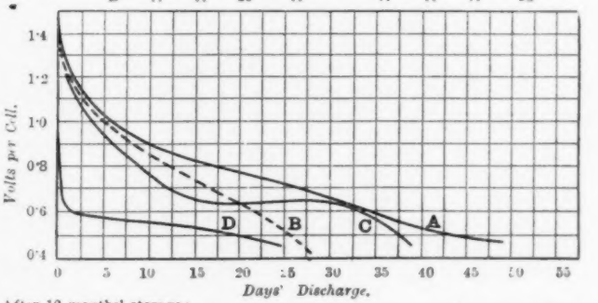
Soon after cells arrived :—

Cells.	To 0·7 volt. Amp. hrs.	Watt hrs.	To 0·5 volt. Amp. hrs.	Watt hrs.	Relative capacity. Watt hrs. To 0·7 volt.	To 0·5 volt.
A	60	55	70	64	100	100
B	44	41	59	48·5	75	76
C	29·5	29	43	35	53	55
D	34·5	33	51	38·5	60	60



After 6 months' storage :—

Cells.	To 0·7 volt. Amp. hrs.	Watt hrs.	Relative capacity. Watt hrs.
A	68·5	·1	100
B	38 6	36	59
C	29	27	44
D	20	17	28



After 12 months' storage :—

Cells.	To 0·7 volt. Amp. hrs.	W..tt. hrs.	Relative capacity. Watt hrs.
A	60	54	100
B	39	36	67
C	29	27	50
D	1	1	2

Fig. 3.—Continuous Discharge Through a Resistance of 10 Ohms Curves of Voltage on Closed Circuit.

tween the relative results of different makes of cells under the various conditions of discharge, and also as to the relation between the incidence of the discharge and the capacity, it seems obvious that, with the exception of No. 1, none of the methods of test investigated can be relied on to give even an approximation of the relative capacity of dry cells or of the

output which may be obtained under working conditions. What may be called a "rough idea" of the relative value might, perhaps, be obtained for telephonic purposes from the results of a continuous discharge through a resistance of 100 ohms, but for a really correct comparison the test should approximate as nearly as possible to working conditions. The author has not made a large number of tests on the larger types of dry cells, such as are used for ignition purposes, but from the results obtained with those that have been tested there seems every reason to believe that the conclusions arrived at as a result

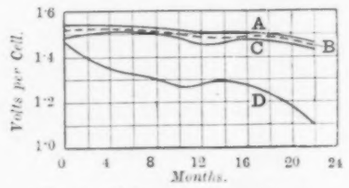


Fig. 4.—Voltage on Open Circuit.

of this investigation would apply also to them; the rate of discharge being, of course, in proportion to the size of the cell.

A standard test of this sort, although it would of necessity take a considerable time and might at first sight be considered laborious, would eventually show distinctly which brand of cell is the best suited to the requirements and would give a very fair approximation of the cost of the energy used. Moreover, satisfactory mechanical arrangements can readily be made for switching the cells off and on, and it is only necessary then to take readings of the voltage about once a week, at, or near, the end of a discharge period. The observations of voltage on open circuit and of internal resistance—at best somewhat indefinite, and always difficult to interpret—would not be required; the process of recording observations would therefore be much simplified.

Milwaukee's Wayside Telephone Service

The Milwaukee fire and police alarm department not only makes good use of the motorcycle in wire maintenance, but its superintendent, Oscar D. Kleinstuber, has developed and is now installing a "wayside" telephone that goes the Detroit "wayside jack connection" considerably more than "one better," according to Frank B. Rodger in the *Electrical World*.

In appearance the box resembles a type of fire-alarm box not uncommon in American cities. The apparatus and door now in use are being transferred to the Kleinsteuber combination box. The front of the box contains the standard apparatus behind a keyless door, and on the right side is the patrol call apparatus and telephone set for the police department. That apparatus, too, is standard, and is being transferred from the police patrol boxes that are being displaced with the new type.

On the left side of the box is the "wayside" telephone for the use of all city departments. Of course, it will not be used ordinarily by the police department, which has its individual wires and separate switchboard owing to the requirements of secrecy. But, if a police department circuit shows trouble, the general municipal telephone can be resorted to in making connection with the police department switchboard through the municipal switchboard in the city hall.

Primarily the municipal telephone system was designed for sanitary inspectors of the health department. Much time was lost by the inspectors because of the lack of ready communication with the health commissioner and the chief of inspectors. To give the health inspectors unlimited use of the police telephones was not considered advisable. Each inspector had a trap key to open police patrol boxes in cases of emergency, but in his routine work had to depend upon private telephones. Saloon telephones were used frequently, impairing discipline.

In addition to health, factory, bakery, milk, building, elevator and street inspectors and employes of other city departments in need of telephonic connection with the city hall, all the public schools, hospitals, public baths, libraries, pumping stations and other public buildings are to be connected with the municipal switchboard in order that there can be inter-communication of departments without going off city lines. Telephone calls with private telephones will be handled over trunk lines connecting the municipal board with the main switchboard of the Wisconsin Telephone Company. The municipal switchboard nearing completion will cost about $2,000.

Each of the 704 fire-alarm boxes is to be replaced with the combination box, giving that number of police patrol boxes and that number of "wayside" telephones. At present there are but 295 police patrol boxes. To combine the fire and police alarm apparatus and to add the wayside telephone at an old location costs but $44.73, of which $40 is for the iron casting, $1.73 for the additional telephone set and $3 for the lamp on the top of the box.

The lamp shows a red light at night in order that fire boxes may be located easily in emergencies. Through an automatic device controlled from police headquarters, any lamp or any number of lamps can be made to flash to show patrolmen they should call up the central operator. The cost of the light will not exceed two cents per night. While the lamp is burning the officer on the beat will know the boxes are in service. When the lamp is extinguished attention will be called to the wire trouble. On his motorcycle the trouble man can locate the trouble and make repairs quickly.

In the old box there was a telegraph key for calling additional apparatus after the first alarm had been sent in with the break wheel. Code call numbers were used, tending toward confusion, in obtaining additional apparatus. With the new box an assistant chief will have a telephone close at hand day or night. For second, third and general alarms he will use the regulation fire-alarm apparatus, but if he wishes only an extra engine or two he can specify his wants over the telephone. With the telephone the chief can call for exactly the amount of apparatus and for the exact number of men he needs at a fire, not decreasing unnecessarily the protection afforded by the men in the houses.

Mr. Kleinsteuber plans to put into service within a few days another motorcycle with free-wheel control, so the linemen can stop at various alarm boxes without stopping the engine. He will also replace a wagon with a motor truck. The city will then sell the last four horses in the fire and police alarm department.

In the Norwegian budget for 1913 provision is made for the expenditure of $405,539 by the Post and Telegraph Department for telephone installations. Details are not supplied.

How the Telephone Averts Catastrophies

In every Southwestern telephone office there is what is known as a "log book," wherein are entered the vital facts of every emergency call, and usually thereafter the notation "service O. K.," which means service secured. Most of these calls come at night, and behind the bare facts noted in the record book or "log" there lurk many stories of great interest, were they known. Investigation of a certain prosaic enough appearing entry in the "log" shows that upon a certain night when a signal blinked the operator inquiring "number?" heard in reply only a sound as of a body rolling about the floor and a hoarse, gurgling, regularly repeated gasp. She secured the street location of this telephone, notified the police and when they arrived a man with his throat cut was found writhing upon the floor near the overturned table telephone.

Some of the incidents in which prompt use of the telephone averted impending calamity are given by Charles Abbott as follows:

March 12 of this year Miss Josephine Miller, an operator at the Main exchange of the Southwestern Company at Dallas, helped to save a man from himself. Discouraged, despondent, the way by carbolic acid poison had appeared to him to offer relief. Alone in his room in the dead of night he drank the fiery liquid.

The fates were with him, however. No sooner had the poison seared his throat than the telephone in his room commenced to ring. Some one, apprehensive lest he attempt suicide, was trying to talk to him. Others in the house heard the clanging of the bell. It continued to clamor vigorously and at last the door was opened by a fellow roomer, who wished to answer and so end the noise. On the bed lay the would-be suicide. The discovery was made barely in time, if help could be summoned quickly.

"A doctor, a doctor! Send a doctor quickly!" came the cry over the telephone.

Miss Miller was alert to the situation and found help, but it was still apparent that the young man must be immediately carried to the hospital. In the emergency the operator again had occasion to act.

The physician who had been summoned put in an emergency call for the Emergency hospital to get the ambulance, but the wagon was in other service. Comprehending the conditions the young woman of the Dallas night guard, without waiting for instructions for any one, called police headquarters and sent the patrol automobile whizzing to the scene.

A few minutes later the doctor who had failed to get the emergency ambulance thought of the police vehicle and called to secure it. He was informed that it was already on the way. He hung up the receiver, looked out of the window and there it was, ready.

Later the doctor called Miss Miller with the news that the victim of his own act had been successfully snatched from the very jaws of death.

Such events are occurring everywhere over Texas and Arkansas almost every night. Recently at Fort Worth Miss Ollie Walling, night chief operator at the Rosedale exchange, played her part in a thrilling drama. Over a wire she heard the sound of a strugggle and then of gasping. The signal kept on burning and it was apparent that something was wrong. The police were notified and hastened to the street number indicated by the young woman of the Fort Worth night guard.

Everything was dark, but the sounds indicated an emergency to the officers just as they had to Miss Walling. A strong shoulder was pressed against the door and the rescuers entered. The lights were flashed on and there a strange and terrible scene met their eyes.

A man with the glint of insanity in his eyes was apparently choking a woman to death. The telephone lay beside them on the floor and it was evident that the woman had been caught and overpowered just as she had lifted the receiver from the hook to call for help.

She had not even uttered the cry of danger and yet was saved because of the human element as applied to the operation of the telephone.

It was the same Miss Walling who another time caught the scream of a terrified woman.

"Help! Police!" came the words and then the line was as silent as if the receiver of the telephone had never been lifted.

In this case as always the subscriber's number was traced back to find the street number and the police were notified.

Shortly afterward the story was unfolded over the telephone wires to the young woman of the night guard, but with the explanation came a request for further assistance.

The police, responding to Miss Walling's call and acting on the information furnished, had hurried to the house from which the cry had come. Upon the floor of the dark room they found an unconscious woman. At the back door was the unmistakable evidence of the attack of a burglar. In her fright the lady had fainted, just as she gave the alarm to the night guard. The police wanted a doctor immediately, because they could not revive her.

Miss Walling had before her a list of physicians who could be summoned in emergency and within a few minutes, one was on the way.

Almost immediately upon his arrival at the house, to show the dependence placed upon the human telephone in emergency, the doctor again called Miss Walling. He reported the woman to be in a critical condition and that her husband, who was in Dallas, must be summoned immediately.

Five minutes after the first alarm the husband was talking over the long distance wires to some one in his home. The next day he called at telephone headquarters to meet the operator who had so successfully helped him.

Hens Telephone for Help

To catch an animal which had been killing his hens, B. E. Moore, a well known poultry raiser of Winsted, Conn., had a telephone installed in his hen house.

The wire ran to his bedroom, where the receiver was fastened to a bedpost close to his pillow. The receiver on the other end was also off the hook, thus permitting any sound in the hennery to travel to Moore's sleeping chamber.

About daybreak one morning Moore was awakened by the shrill cackling of his hens coming over the wire. Half dressed, he grabbed a gun and started for the hen house, where he shot and killed the thief, a mink.

Moore will not take the telephone out of the hennery, because the crowing of the roosters coming over the wire in the early morning beats any alarm clock he ever had.

The Telephone Scrap Book

Conserving Wire in Distributing Frames

A VALUABLE method for conserving cross-connecting wire used on distributing frames is described by W. R. Hirst in the *Bell Telephone News*. During the past three years, says Mr. Hirst, the accumulation of various lengths of flame-proof, cross-connecting wire, both double and triple, showed a remarkable increase

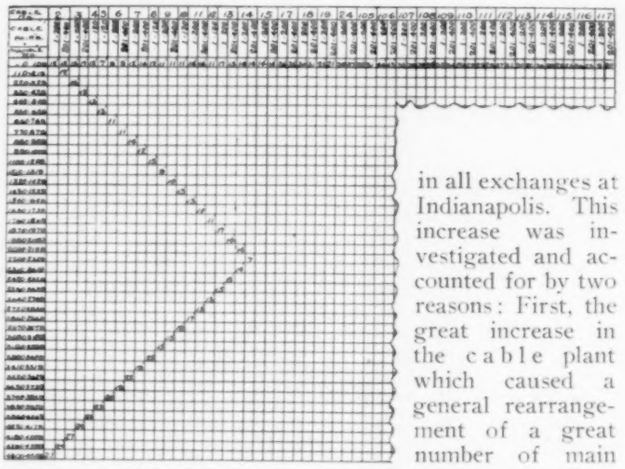


Diagram 1. Chart Showing Length of All Cross Connections on Main Frame.

in all exchanges at Indianapolis. This increase was investigated and accounted for by two reasons: First, the great increase in the cable plant which caused a general rearrangement of a great number of main and intermediate cross-connections. Second, because no satisfactory method had been provided for the proper measuring of wire when it was taken from the frames and no accurate estimate could be made of the length of the wire which should have been reused. The consequence was that we found ourselves accumulating lengths of this wire ranging from

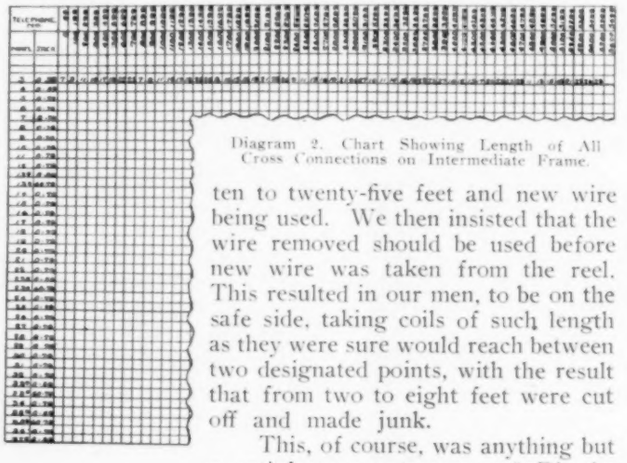


Diagram 2. Chart Showing Length of All Cross Connections on Intermediate Frame.

ten to twenty-five feet and new wire being used. We then insisted that the wire removed should be used before new wire was taken from the reel. This resulted in our men, to be on the safe side, taking coils of such length as they were sure would reach between two designated points, with the result that from two to eight feet were cut off and made junk.

This, of course, was anything but a satisfactory outcome, and District Plant Chief McMaster set about devising some way of getting accurately at the lengths of wire removed, and at the distance between designated points on the frames between which the removed wire could be reused. That which follows is the result:

On October 1, 1911, it was estimated that we had on hand in the Indianapolis main exchange 3,000 pieces of flame-proof wire varying in lengths from seven to twenty-five feet, with an average of about twenty feet, making a total of 60,000 feet of good wire. At this time we made a reel, took the necessary measurements of the main and intermediate frames and started our new system as outlined below and in the diagrams herewith, with the result that the stock of short lengths of wire on hand in the main exchange, with the same amount of work going on, had been reduced from 3,000 to 100 pieces by December 1, 1911.

In order to measure and coil the wire removed from either main or intermediate frames, a small reel with a circumference of three feet (diameter 11 15-32 inches) should be made. This reel can be placed at one end of the frame or at any other suitable place near the frame. One end of the removed cross-connection wire should be placed in the small hole on the rim of the reel and the reel revolved until the wire is coiled.

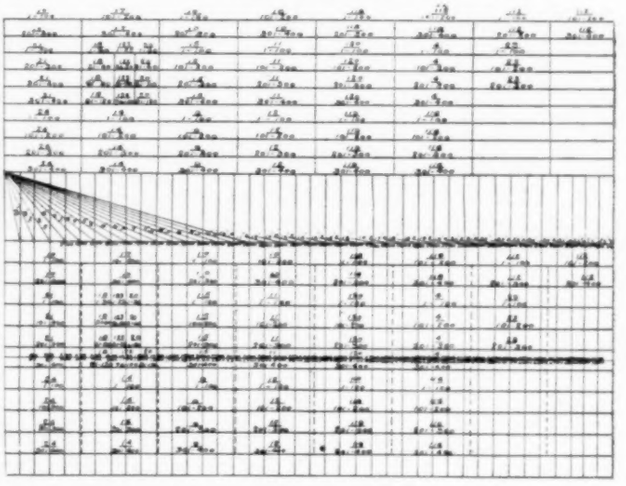


Diagram 3. Showing Method of Obtaining the Length of Cross Connections for Main and Intermediate Frame Charts.

The wire should then be removed from the reel, the length noted (the length in feet being determined by multiplying the number of turns by three) and placed on a peg reserved for that particular length of wire. A rack consisting of pegs to be used for the various lengths should be kept on the wall near the frame, the limits of each peg being not to exceed one turn of the reel, or three feet; in other words, one peg should be maintained for wires varying from seven to ten feet; another peg for wires from eleven to fourteen feet; another peg for wires from fifteen to eighteen feet, and so on.

After receiving an order for a new cross-connection, the first thing to determine is the length of wire required. In order to do this a chart should be prepared, one for the main frame and one for the intermediate frame, showing the approximate lengths of the various cross-connections. Every possible cross-connection, however, should not be shown, as this would make the chart so large as to be cumbersome. The chart should be designed so as to show the longest cross-connection from any particular cable to any articular section of the switchboard side.

Diagram No. 1 attached is for a main frame where the cables terminate on the horizontal side and the

switchboard cables in 200-pair sections on the vertical side. This diagram No. 1 is not complete, only a part of the square being filled in to show the general scheme.

Diagram No. 2 shows the scheme for a chart to be used for the intermediate frame.

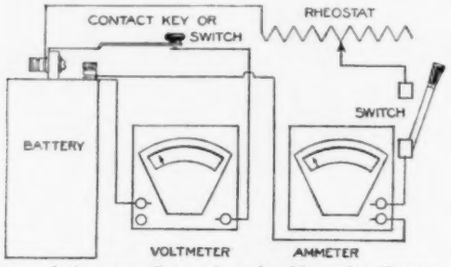
After the length of the cross-connection wire has been determined by means of the chart, the same can be immediately secured by removing wire from the peg showing the proper length.

In order to make up a chart showing the various lengths of cross-connections on either main or intermediate frames, it is suggested that a small drawing reproducing the two sides of the frame be prepared, placing the two parts of the drawing the same distance apart as the actual width of the frame, according to the scale used. From this drawing it would be a very simple matter to measure the length of all combinations on the frame.

Drawing No. 3 shows a scheme for measuring the lengths of cross-connections on an A-type main frame.

Measuring Internal Resistance of Batteries

THE current that can be obtained from a battery is dependent not only upon the electromotive force and the resistance of the circuit to which the battery is connected, but, in addition, upon the internal resistance of the battery. The principal factors upon which the internal resistance of a battery depends are the area of the plates forming the electrodes; the distance between these plates; the kind of electrolyte used; the age of the battery, and the current the battery is supplying. As the internal resistance of a battery increases,



Voltmeter and Ammeter Connections for Measuring Battery Internal Resistance.

due to any cause, such as continued use; drying out of the paste used in dry cells; decrease in area of plates, etc., the current it is capable of supplying to a given circuit decreases and, as a result, the battery in time will fail to operate any devices that may be connected in circuit.

The internal resistance of any cell can be determined as follows, according to *Popular Mechanics:* The voltage of the battery is first measured by means of a voltmeter, having a comparatively high resistance, when the battery is connected to the voltmeter alone. This reading is called the open-circuit voltage, and we will represent it by the symbol E_o. Now connect a variable resistance (rheostat) and an ammeter in series to the battery terminals, allowing the voltmeter to remain connected, and place a switch in both circuits, as shown in the figure. (If the voltmeter be constructed with a key for opening and closing its circuit, no switch need be connected in series with it.) The circuits may now be closed and readings taken on the ammeter and voltmeter as promptly as possible after the current has been adjusted to the desired value. This second reading of the voltmeter is called the closed-circuit reading, and we will represent it by the symbol *Ec*. The difference between the closed and open-circuit readings of the voltmeter represents the pressure required to cause the current to pass through the internal resistance of the battery. The current, *I*, was read on the ammeter and the internal resistance can now be calculated by dividing (*Eo—Ec*) by *I*, or

$$\text{Internal resistance } (R_{int}) = \frac{Eo - Ec}{I} = \text{ohms.}$$

The internal resistance can be determined for different currents and after the cell has been operating or connected in circuit for different intervals of time. The battery should be given ample time to recuperate after each set of readings before the following set is taken.

The ammeter can be dispensed with by using a piece of wire or a coil, whose resistance, *Rc*, is known, instead of the rheostat. The current can be determined by dividing the closed-circuit voltage by the resistance, *Rc*, connected to the battery.

$$\text{Current } (I) = \frac{\text{Closed-circuit voltage } (Ec).}{\text{Resistance of coil } (Rc).}$$

If the voltmeter has a rather low resistance, considerable current will be taken from the battery to operate it, and its indication, when there is no resistance across the battery, will not be the total voltage of the battery, as there is a small part of the total battery pressure required to cause the voltmeter current to pass through the internal resistance. Hence it is desirable to have a high-resistance voltmeter.

A Private Long-Distance System

A PRIVATE long distance telephone system covering a distance of 152 miles is described by Benjamin Waller in the *Bell Telephone News*. It is owned by the General Motors Company of Michigan and connects its branches. The line consists of No. 12 N. B. S. G. hard-drawn copper wire. It is arranged, however, that in emergencies, such as those due to storms, the wire chiefs at the various exchanges of the telephone company may substitute any side circuits or phantom circuits that are available. It is even possible that in serious emergencies these circuits could be connected by indirect routes.

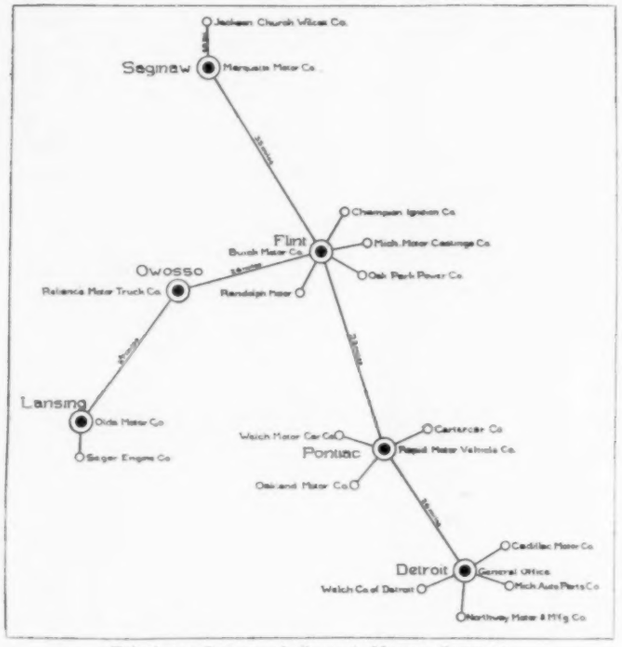
The pole line upon which these lines are carried are the regular toll routes of the Michigan State Telephone Company, varying from twenty-five foot to forty foot lines. The local lines are connected by means of the regular exchange pole lines and exchange cables. Each part is, therefore, under the care of the plant employes of its particular locality, while in a general way the entire line can be watched and tested by the division toll wire chief.

The line will ordinarily be divided into three parts, which will be connected from time to time by the private branch operator at Flint. There are several plants at Flint belonging to the General Motors Company, but for the present the switching will be done in the plant of the Buick Motor Company. All three lines will be connected at night after usual office hours, so that calls may be sent from and to any point on the system if it is so desired.

This line connects only to the private branch switchboard operated by the General Motors Company at the

various subsidiary factories, and as all these private branch exchanges are connected to the exchanges of the Michigan State Telephone Company at each city in which they are located, it is possible to route calls from the residences of the managers or from any telephone at which any of the persons connected with the management may find themselves.

The private branch exchanges are of various standard types, the smaller office and factories having



Telephone System of General Motors Company.

small boards and the larger factories, such as the Buick Motor Company and the Olds Motor Company, having more elaborate systems, equipped with lamp signals and other necessary appliances suited to their traffic.

Those telephone employes who have found it part of their work to visit these various factories during the progress of the installation have been impressed with the ability of the private branch operators. In addition to the routine duties of operating, these operators display a detailed knowledge of the business that is unusual. The exigencies of automobile manufacturing have developed speed and precision, and the operating of their private telephone system is no exception. The volume of the traffic is large and is continued over long hours, thereby differing from the telephone traffic of many other industries. One special difficulty is in locating the important members of the management, who have to move continually from point to point around large factories and yards.

The circuits used on the long distance line are the same as used in standard toll line practice. The various local lines at each city are operated by common battery systems, so that the supervision of recall or disconnected signals is covered by the movements of the receiver hooks and the possible efficiency of the line is thereby maintained at its highest point. It is hoped that the total volume of business handled over this line may be kept at its highest point by a system of preference. For instance, certain calls may be considered emergency calls and be handled first, while ather business in the nature of routine will be so listed when the call is made and will be handled during periods when the line is not otherwise crowded. This is something which cannot be done by a public-service telephone company, yet its possibility can be readily appreciated by any telephone man and the results of this attempt will be watched with great interest.

This seems to be one of the most striking illustrations of the changes in social and industrial conditions which are occurring and in which it seems entirely proper for the telephone man to take consderable pride. If it were not for the methods made possible by the telephone and a few other modern conveniences, these interrelated plants would have to be crowded together in such a way that conditions of living and working would be much more unsatisfactory. As it is, the names of the towns on the map reproduced here mean to the Michigan man places of good homes. They are towns not too big to live in comfortably and yet where everything can be procured that is desirable to the modern civilized family.

A Magnifier for Cable Telegraphy

THE speed of transmission on long submarine cables is limited, as is well known, by the definition at which signals are readable on the syphoon recorder slip. From time to time inventors have sought to find a means of magnifying the unreadable wavy line produced when the speed is pushed above the limit.

In a recent number of the *Archiv für Post und Telegraphie*, Von Luers describes the experiments made on the Emden-Vigo cable with the magnifier invented by the English cable electrician, Heurtley, and from this paper some of the following particulars are translated by *Electricity*.

Referring to Fig. 1, the arrangement of the magnifier is shown diagrammatically. The syphon coil is attached by quartz fibers to a small platform bifilarly suspended, and on which is fixed a thin bronze wire *BD*

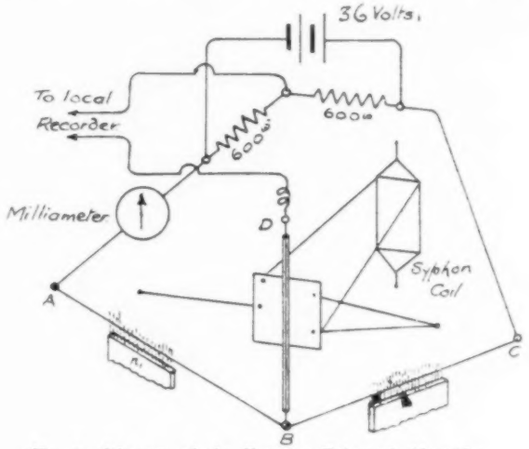


Fig. 1. Diagram of the Heurtley Telegraph Magnifier.

rendered rigid by means of a glass tube. To the lower end of *BD* is attached two thin platinum wires *AB*, *BC*, which are normally under the influence of air blasts from nozzles m_1, n_2. The three wires from part of Wheatstone bridge network as clearly shown in the diagram.

A battery of 36 volts sends a current through the network and, under normal conditions, the two wires

are equally heated by the permanent current and cooled by the two blasts of air, so that the bridge balance is not disturbed and the local recorder in circuit simply traces a straight line. On signals being received, one of the wires *AB* or *BC* is moved more or less out of the cooling current of air and is unequally cooled, the bridge balance is upset, and the local recorder actuated.

Of the efficacy of the arrangement there can be little doubt, as a glance at the two specimen slips in Fig. 2 will show. Slip *a* shows signals received directly

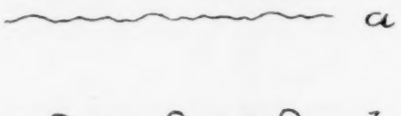


Fig. 2. Comparison of Magnified and Unmagnified Transmission.

on the syphon recorder, while slip *b* is taken with the magnifier in circuit, both slips corresponding to a speed of transmission of 190 letters per minute on the Emden-Vigo cable.

The magnifier has been in use on this cable for several months both at Emden and Vigo, and has raised the speed, when working duplex, from 135 to 190 letters per minute, or, roughly, 40 per cent.

The magnification which increases with the heating of the wires, can be made the greater, the more perfect the duplex balance that is attained.

The Wheatstone bridge method of magnification has been suggested before, notably by Charles Cuttriss and Raymond Barker, though the writer does not remember seeing any results published.

The German author predicts a great future for the Heurtley magnifier in cable telegraphy, and all telegraph men will join in hoping that his prophecy will be fulfilled.

Curious Cable Damages

NO ONE feature has a greater importance in its bearing on the delivery of service than the condition of the company's cable plant, says *New England Telephone Topics*. A single station out of order means a customer without service. A storm which may put out a large number of stations is proportionately more serious, but the going out of a cable can only be compared with the deluge.

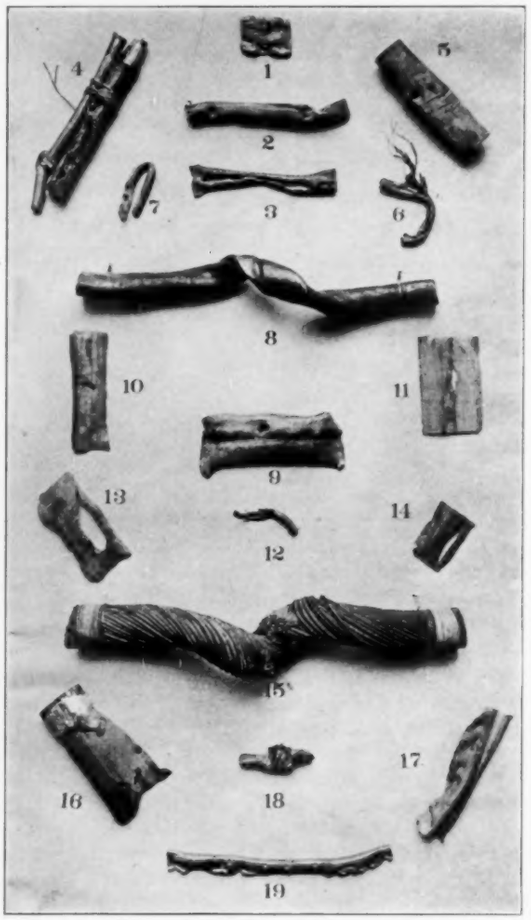
There is a specialized body of men in the plant department responsible for the placing and maintaining of cables who seldom come into the limelight and then only because of most unfavorable circumstances. Most of us know that the company uses cables; some of us realize to a greater or less extent that these cables represent a very large outlay of money. Under ordinary circumstances, however, it is only when a break comes that the cable force comes into our minds and at that time our thought is usually, "I wonder how long it will take them to clear the break." The man with a red flag in his hand standing beside the opening of a manhole invariably means that there is work of the most important nature going on. It is at such times when time and physical fatigue must not be considered—when the only thing to do is to clear the cable and to clear it in a hurry.

Unfortunately, no one has as yet invented a cable that will be indestructible by the elements or by man's misapplied energy. That the routing of the cable force is not confined to the making of studies, or the doing of spectacular construction work, is rather forcibly brought out by the accompanying photograph, showing some of the little things which help to vary the monotony of the cable man's life.

No. 1. Taken from a 30 pair, 19 gauge cable at Lynn, Mass., showing a 44-caliber bullet hole clear through the cable. This trouble was cleared on the day reported.

No. 2. Shows the damage done by a street employe while using a pick on Woodbury street, Beverly, Mass.

No. 3. Taken from a 30 pair, 22 gauge cable on Bartlett street, Beverly, Mass., and is the result of a



A Group of Curious Cable Injuries.

squirrel's gnawing the cable—not an uncommon trouble in some sections of the country.

No. 4. Taken from a 30 pair, 22 gauge cable at Glenmere square, Lynn, Mass., and showing a span-wire burn. Cleared on the day reported.

No. 5. Taken from a 180 pair, 19 gauge cable on Lafayette street, Salem, Mass., showing damage by street department men with both pick and ax. This trouble was cleared in about thirty-six hours and necessitated digging up the street.

No. 6. Taken from a 26 pair, 22 gauge cable on Lynnfield street, Lynn, Mass., showing the result of a lightning bolt.

No. 7. Taken from a 15 pair, 22 gauge cable on Bridge street, Salem, Mass., showing a cable entirely severed by waterworks employes.

Nos. 8 and 15. Shows a rather interesting case of trouble taken from the submarine at Kittery, Me. The tide at this point runs with unusual velocity and two complete twists were put into the cable. No. 8 shows one twist with the armor removed and No. 15 shows the other twist with the armor still on the cable.

No. 9. Taken from a 30 pair, 19 gauge cable at Nahant Beach, showing an electric light wire burn. Cleared the day following its report.

No. 10. Taken from a 30 pair, 19 gauge cable at Lynn, Mass., showing a trolley burn.

No. 11. Taken from a 60 pair, 19 gauge cable showing an electric light wire burn. Cleared day following report.

No. 12. Taken from a 15 pair, 22 gauge cable, showing the result of lightning.

No. 13. Taken from a 60 pair, 22 gauge cable at Marblehead showing a span wire burn caused by street railway employes while repairing their own system.

No. 14. Taken from a 30 pair, 19 gauge cable at Kittery, Me., showing a burn from foreign current.

No. 16. Taken from a 120 pair, 19 gauge cable at Dover, N. H., showing a trouble caused by a No. 12 wire pulled into a spare duct twisted around the cable.

No. 17. Taken from a 30 pair, 19 gauge cable at Hampton, N. H., showing a number of bullet holes.

No. 18. Taken from a 15 pair, 19 gauge cable showing the result of lightning.

No. 19. Taken from a 30 pair, 22 gauge cable at Leominster, Mass., showing a number of buckshot holes.

Inductance of Telegraph Apparatus

ALTHOUGH values of the electrical constants of the apparatus used by the Post Office have from time to time appeared in various publications, says the *Post Office Electrical Engineer's Journal* of London, it is found that owing to the adoption of new types of circuits and other modern developments, further and more exhaustive measurements are now desirable, and accordingly the research branch of the engineering department of the British Post Office has undertaken the work.

The measurements of the inductance of telegraph apparatus have been completed, and the results are given herewith.

The method used is that shown in the diagram, generally known as Anderson's method.

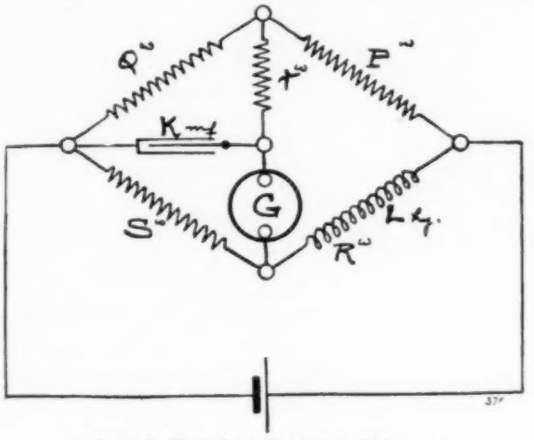
The bridge is first balanced for resistance in the ordinary manner. The battery and galvanometer keys art then depressed in the reverse order, and K and r varied till no kick is produced on the galvanometer. When this condition has been obtained the inductance is given by the following formula:

$$L = \frac{K}{10^6}[r(R+S)+RQ].$$

The proof of this formula will be found in "Electrical Laboratory Notes," No. 47, and also in "A Handbook for the Electrical Laboratory," Vol. II., p. 192, both by Dr. J. A. Fleming.

It will be observed that the inductance of any particular instrument is not constant, but tends towards a maximum. In several cases the maximum has been passed and the inductance thereafter decreases as the current is increased. This is due to the permeability of the iron cores decreasing when the flux becomes large; in fact, the permeability and the inductance vary together.

It will also be noticed that the inductance obtained with differentially wound instruments, when the coils are joined in series, is always about four times that obtained with the same instrument when the coils are joined in parallel. With the coils in series the effective



Anderson's Method of Measuring Inductance.

number of turns is twice that when the coils are in parallel, and since the inductance varies as the square of the number of turns the above result follows at once.

The fact that the inductance with the coils in series is not exactly four times that with the coils in parallel is due to the presence of the iron cores and also to magnetic leakage.

Attention is drawn to the change in inductance produced by the movement of the armature of sounders and similar instruments.

The Mortier System of Telegraphing Pictures

The Mortier system of telegraphic transmission of pictures requires no special electrical apparatus, and is capable of use in conjunction with any ordinary telegraph line. The picture to be transmitted is resolved into a number of tiny sections, the relative brightness of which is observed and telegraphed in a predetermined order and according to a predetermined code. According to instructions thus received, the picture is recomposed, at the receiving station, by "microtype."

Since the eye is incapable of estimating brightness differences with accuracy sufficient for the above purpose, the original is photographed through a special screen composed of ten transparent sheets, marked out in equal squares, but variously filled in with different geometrical patterns. The reproduction appears divided into a number of "fields," each containing a certain number of points and lines to which various brightness figures can be attached by observation. The prepared picture is mounted in a frame, over which the observing apparatus can be run to and fro. The eye piece of the latter allows about 20 of the "cells" (as Mortier calls the fields of the picture) to be observed at once, and the operator simply dictates, in a definite order, the various brightness figures of the picture. On receipt of the code message, which may be variously arranged to lessen the cost of transmission, the picture is set up with microtype, the thick-

ness of the lines and the size of the dots of which reproduce the desired apparent brightness of the various parts of the picture.

At first sight the process appears crude, but the results attainable by its use are said to be very satisfactory, and certainly the simplicity of the apparatus required is a great point in its favor. Working with six degrees of brightness, results quite good enough for newspaper and similar work can be obtained. An average small picture is divided into about 3,900 points, and the brightness data are transmitted by 880 pairs of figures which may, for cheapness, be sent at 440 words. The preparation of the original, the transmission of the brightness figures, and the setting up of the microtype for such a picture may occupy about one-half hour each—one and one-half hours in all. Under the most unfavorable conditions, it is possible to have a block ready for printing within two or three hours after taking the original photograph at any place within reasonably direct telegraphic communication.

Greek Alphabet in Electrical Work

GREEK letters are used largely in technical articles and the accompanying table, showing their names and the quantities they are commonly used to designate, may be of interest. It is not the purpose of TELEPHONE ENGINEER ever to overburden its readers with mathematics, for few of us really like it; but sometimes we have to use it.

Name.	Large.	small.	Commonly used to designate.
alpha	A	α	angles, coefficients.
beta	B	β	angles, coefficients.
gamma	Γ	γ	specific gravity.
delta	Δ	δ	density, variation.
epsilon	E	ϵ	base of hyperbolic logarithms.
zeta	Z	ζ	co-ordinates, co-efficients.
eta	H	η	hysteresis (Steinmetz) coefficient, efficiency
theta	Θ	θ	angular phase displacement
iota	I	ι	
kappa	K	κ	dielectric constant.
lambda	Λ	λ	conductivity.
mu	M	μ	permeability.
nu	N	ν	reluctivity.
xi	Ξ	ξ	output coefficient.
omricron	O	o	
pi	Π	π	circumference $\div$ radius.
rho	P	ρ	resistivity.
sigma	Σ	σ	(cap.), summation; (small), slip
tau	T	τ	time phase displacement.
upsilon	Y	υ	leakage coefficient.
phi	Φ	ϕ	flux.
chi	X	χ	
psi	Ψ	ψ	
omega	Ω	ω	(cap.), ohm; (small), angular velocity.

In the five years covered by the last census of the telephone industry there were added about 8,000,000 miles of wire to the telephone systems in this country.

Proposed Patent Legislation

A bill, House Bill No. 23,193, has been introduced in the house of representatives, a similar bill in the senate, entitled a bill to codify, revise and amend the laws relating to patents.

The bill as introduced makes many minor changes in the law and some of much importance which should be carefully considered and given much thought before they are enacted into law.

By the bill it is proposed to constitute a board of appeals consisting of the commissioner of patents, the two assistant commissioners and the examiners-in-chief, any three of whom shall constitute a quorum. A patent bar is also provided as well as a registration fee of $5 and annual dues of $1 for representing patent clients before the patent office, which may be employed in defraying the expenses of examining applicants for admission and for such investigations as may be necessary. The money remaining is to be paid into the treasury and added to the accumulations already collected from the army of inventors. To secure a proper standard of advertising matter all registered attorneys are required to file with the commissioner of patents not less than thirty days before the same are issued for general circulation, copies of all advertising matter framed to solicit business or to secure sale of patents and violation of this may cause suspension or disbarment of the attorney.

While it is provided that the patent shall contain a grant "for the term of seventeen years, every patent shall be so limited as to expire nineteen years from the date of filing the application exclusive of the time consumed by the patent office, courts and in interference."

A compulsory license provision is included in the bill granting a right of appeal to the circuit court of appeals from the granting or refusing to grant such a license. Applicants for patents or reissues, who are not domiciled in the United States, must designate by a notice in wrinting, filed in the patent office, some person residing in the United States on whom process or notice of proceedings may be served with full effect.

The time for prosecuting a patent application is reduced from one year to six months after an official action.

The act reverses the fees making the filing fee of applications for patent $20 instead of $15 and the final fee $15 instead of $20 as at present. At first glance this appears to be the same thing, but many applications for patent for one reason or another do not eventuate in the issue of patents, so that a considerable additional revenue should result.

The bill was introduced in the house by Chairman Oldfield of the committee on patents and was referred to his committee, which will doubtless arrange for hearings at which those interested may appear and discuss the merits and demerits of the proposed law from various points of view. Mr. Oldfield has also introduced a bill seeking to make it unlawful to insert a condition in any contract relating to the sale, lease, or license to use any article or process protected by a patent or patents, the effect of which will be to require the purchaser, lessee or licensee to acquire from the seller, lessor or licensor or his nominees, any article or class of articles not protected by the patent, and to nullify any such condition as being in restraint of trade and contrary to public policy.

The Invention of the Telephone

By Prof. Alexander Graham Bell*

I FEEL it is a little presumptuous upon my part to try to speak of the telephone to telephone men. You have all gone so far beyond me! Why, the little telephone system that I look back upon—what is it compared to the mighty system that goes through the whole extent of our country today? It is to you that this great development is due, and I feel that it behooves me to speak very modestly of the little beginning that led to this great end. I can not speak to you about undulating current, intermittent current and pulsatory current. I belong to the past, you belong to the present. You know all about many of the later developments of the telephone; you may not be so familiar with the earlier ones.

The period that marks the incipiency of the telephone was the years 1874 to 1877. It was in 1877 that the telephone really began its commercial career. I shall deal chiefly with the points that preceded 1877. Of course, in dealing with this period of the history of the telephone I shall have to be somwhat personal, for it all centered upon me in those days.

From 1873 until the beginning of 1876 I was a resident of Salem, Massachusetts, and came into Boston every day for my professional work. Then I would spend my summer vacations in Canada, at Brantford, at the home of my parents. So these three places—Salem, Boston and Brantford—are concerned in the early days of the telephone. Boston is *par excellence* the home of the telephone, for it was here that all the apparatus was made and where the important experiments went on. Brantford, in Canada, was my thinking place, where I would go and spend my summer holidays and look over the line of experiments that had been made in Boston and plan for the future.

And so it happened that in the summer of 1874, during my visit to my father's house in Brantford, Ontario, considering myself and discussing with my father the numerous experiments I had made in Boston relative to the reproduction of musical sounds by electricity for the purpose of multiple telegraphy, the thought of the membrane telephone was elaborated. So the conception of the telephone originated in Brantford, Ontario, in the summer of 1874. You are all familiar with it. It was a theoretical conception of a magneto telephone, a very daring conception, if I may be allowed to say so—that the vibrations of the voice might create electrical impulses like the aerial impulses, and produce an audible result at the other end. To tell you the truth, as a practical man I did not quite believe it; as a theoretical man, I saw a speaking telephone, that theoretically we had the means of transmitting and reproducing speech in distant places. But it really seemed too good to be true that you could possibly create electrical impulses that would amount to any practical purpose by the action of the voice itself.

And so, on my return to Boston in October, 1874, and all through that winter and through the spring of 1875, instead of making the apparatus and trying it I was trying to devise methods of increasing the strength of these electrical undulations. I was working at what is now known as the variable resistance method. That is shown very well in a letter that I wrote to Mr. Hubbard on the fourth of May, 1875, when I was experimenting on the passage of a voltaic current through a vibrating wire, with the idea that the variation of tension in that wire, by producing vibrations in the resistance of the circuit, would produce the electrical undulations that I desired.

From the summer of 1874 up until June 2, 1875, the development of the telephone was delayed by this thought, that the magneto-electric impulses would not be sufficient by themselves and would require a battery current.

Then came the discovery, with which you are all probably familiar, that a magneto-electric current would produce by itself sonorous effects at a receiving station, and you may remember the plucking of reeds that went on that celebrated June 2, 1875. In a moment all the difficulties in the way of the practical solution of the telephone disappeared, and orders were given at once to construct the membrane telephone that was conceived in Brantford in 1874. When it was first tried it was somewhere about the end of June or July 1, 1875. We had only one membrane telephone, and the receiver was one of the old tuned reed receivers. It was held up to the ear. You crammed the armature against the ear to dampen its vibrations. I was listening at that armature while Thomas A. Watson, my assistant, was down in the basement of Charles Williams, Jr.'s, building, 109 Court street, shouting at the end of the telephone, and then we changed places. I may say that I heard nothing. Then Mr. Watson went downstairs to listen, and I went upstairs to speak, and while I was speaking Mr. Watson came rushing up the stairs in a state of great excitement, saying, "Why, Mr. Bell, I heard your voice very distinctly, and could almost understand what you said." Well, that was gratifying, but it would have been still more gratifying if I could hear that, too. You see, Mr. Williams' workshop was a very noisy place. Mr. Watson was accustomed to that noise and could hear a good deal better than I. I was more accustomed to throwing out my voice than Mr. Watson, so that he had the advantage of me in hearing and I had the advantage of him in speaking. The results would be very unsatisfactory at the present time; yet, encouraged by the results, poor as they were, I went ahead immediately to prepare specifications for a patent. In September, 1875, I was at work upon the specifications of the now celebrated patent. In October, 1875, the patent was completed. But it was not filed in October, 1875. A long delay ensued, because I was so imbued with the idea of this great invention that I was not satisfied to take out patents for America alone—I must take them out for every country on earth. But that, you know, required money, and I did not have the money. Mr. Saunders and Mr. Hubbard, who were associated with me and carried on my experiments, paid the cost of my experiments and of the American patent. They were too wise to touch foreign patents. So I had to go ahead and see what I could do to get this great patent taken up abroad, and that caused great delay. I went up to Canada to interview friends in Canada, and at last made an agreement with the Hon. George Brown, who

*Abstract of an address before the Telephone Pioneers.

was at one time Premier in Canada, that he and his brother, Gordon Brown, would take out patents in England and perhaps other countries, on one condition—that I should not file my application for an American patent until I had word from them that it would not interfere with the patents abroad. And so it was that the American patents dragged on for months, until at last Mr. Hubbard just said a quiet word to my solicitors in Boston: "It is no use waiting longer for Mr. Brown; just you put in the patent." And the patent was filed without my knowledge or consent. It is very fortunate that he did so. It saved a great deal of trouble and interference in the patent office, and so forth, and that is the patent on which the whole telephone system of the United States has been based.

After the granting of the patent came a period of publication, and I want to speak now of a very curious thing. In the case of new inventions we are generally led to believe that the public is ready to swallow anything, but that grave scientific men are the most skeptical of all. I found just exactly the opposite to be true in the case of the telephone. The public generally and the business men of the country were very slow to perceive any value in the telephone. The scientific world, on the other hand, took it up at once. Mr. Hubbard and Mr. Saunders, who were financially interested in the telephone, wanted this instrument to be exhibited at the Centennial Exhibition in 1876. In those days—and even up to the present time I am afraid it is true—I was not very much alive to commercial matters, not being a business man myself. I had a school for vocal physiology in Boston. I was right in the midst of examinations. My pupils, those studying under me, were studying to become teachers of the deaf, teaching speech to the deaf, and I could not be bothered at that time by having to go to Philadelphia and attend the exhibition. However, we found, in connection with the exhibition, that all the apparatus involving a necessity for quiet was to be examined on Sunday, June 25; and so it was urged that Sunday would interfere less with my professional pursuits than another day. I agreed, therefore, to go down and spend Sunday, and no longer. So I went down to Philadelphia, growling all the time at this interruption to my professional work, and I appeared in Philadelphia on Sunday, the 25th. I was an unknown man and looked around upon the celebrities who were judges there, and trotted around after the judges at the exhibition while they examined this exhibit and that exhibit. My exhibit came last. Before they got to that it was announced that the judges were too tired to make any further examination that day and that the exhibit would be examined another day. That meant that the telephone would not be seen, for I was not going to come back another day. I was going right back to Boston.

And that was the way the matter stood—when suddenly there was one man among the judges who happened to remember me by sight. That was no less a person than His Majesty, Dom Pedro, the emperor of Brazil. I had shown him what we had been doing in teaching speech to the deaf in Boston, had taken him around to the school for the deaf and showed him the means of teaching speech, and when he saw me there he remembered me and came over and shook hands and said: "Mr. Bell, how are the deaf mutes of Boston?" I said they were very well and told him that the next exhibit on the program was my exhibit. "Come along," he said, and he took my arm and walked off with me—and, of course, where an emperor led the way the other judges followed. And the telephone exhibit was saved!

I went off to my transmitting instrument in another part of the building, and a little iron box receiver—you probably all know what it was from diagram—was placed at the ear of the emperor. I told him to hold it to his ear, and then I heard afterwards what happened. I was not present at that end of the line. I went to the other end and was reciting, "To be or not to be, that is the question," and so on, keeping up a continuous talk. I heard afterwards from my friend, William Hubbard, that the emperor held it up in a very indifferent way to his ear, and then suddenly started and said: "My God! it speaks!" And he put it down; and then Sir William Thomson took it up, and one after another in the crowd took it up and listened. I was in another part of the building, shouting away to the membrane telephone that was the transmitter. Suddenly I heard a noise of people stamping along very heavily, approaching, and there was Dom Pedro, rushing along at a very un-emperorlike gait, followed by Sir William Thomson and a number of others, to see what I was doing at the other end. They were very much interested. But I had to go back to Boston and couldn't wait any longer. I went that very night.

Now, it so happened there, that although the judges had heard speech emitted by the steel disk armature of this receiving instrument, they were not quite convinced that it was electrically produced. Someone had whispered a suspicion that it was simply the case of the thread telegraph, the lovers' telegraph, as it was known in those days, and that the sound had been mechanically transmitted along the line from one instrument to the other. Of course, I did not know about it at that time; but when the judges asked permission to remove the apparatus from that location I said: "Certainly, do anything you like with it." But I could not remain to look after it; they had to look after it themselves. My friend, Mr. Hubbard, who had kindly come up from Boston to help me on this celebrated Sunday, said he would do his best to help them out, although he was not an electrician. But he undertook to remove this apparatus and set up the wire under the direction of the judges themselves. So they had an opportunity finally of satisfying themselves that speech had really been electrically reproduced. Sir William Thomson's announcement was made to the world in England, before the British Association, and the world believed, and from that time dates the popular interest in the telephone.

That was the 25th of June. Of course, the judges and others were anxious to know whether this thing would operate on a long line. Experiments had been made from one room to another in a building; but that was not quite as satisfactory as having one telephone in one place and another in another a hundred miles off. So I was asked whether I would venture to try the instrument between Boston and Philadelphia. Well, I, in my ignorance of the conditions, said: "Of course, yes." So when I went to Boston I began to consider: "Now, what are we going to do? These instruments are only prepared for short circuits." So we began to make experiments in Boston to fit the instruments for use on a longer line. I knew that we

must have many turns of quite fine wire in the instrument; so I had such instruments constructed, and then the Atlantic & Pacific Telegraph Company in Boston kindly lent me the use of their wires for experiment. On July 7, July 9 and July 12, 1876, attempts were made to use the telephone upon various circuits from Boston to New York, from Boston to Rye Beach, and other places, but, unfortunately, with poor success. We did not get any vocal sounds on these circuits, although with two instruments, one in one room and another in another room of the Equitable building and a circuit to Rye Beach we did get some audible effect. But still the results were unsatisfactory where the undulating current was employed. We tried the intermittent current. I had a parlor organ, and made contact with New York and asked the operator to listen and see if he could hear anything. I played tunes on the parlor organ, and he was asked if he could hear anything, and he said, "Yes." "What is it?" "Yankee Doodle." He could hear tunes, but that was really the only result of importance obtained in those trials of July 7, 9 and 12, 1876.

Sir William Thompson was present at later trials, and I presented to him a telephone that we used on that occasion, and it was taken to England and bothered me exceedingly in telephone litigation at a subsequent time. The owners of my English patent had to disclaim everything that was shown in those instruments. Sir William just threw the whole thing in his trunk, and when it arrived in England the armature, instead of being flat, was jammed up. Well, that saved the English patent. Everybody got the idea that the vibration was from this cocked-up thing. The English patent showed the cocking up of the armature. When it finally came before the Supreme Court of England, when they were deciding the case, the thing looked rather slim, according to the English law. The shreds of the patent were there—nothing was left but the metallic diaphragm. But they made a very singular construction. They said, according to a very benevolent construction of the law, as they construed it, that it did not interfere with the patent for metallic armature, and the patent was saved.

That brings me up to July 12, 1876. Then came my summer vacation of 1876. I went up to Brantford, Ontario. I prepared a whole lot of apparatus, telephones with coils of different kinds, high-resistance coils and low-resistance coils, long coils and short coils, and I carried them up with me to Brantford, and continued attempts to get in touch with long-distance lines. The Dominion Telegraph Company of Canada kindly lent me the use of its wire, and I look upon one experiment there as of very great importance. It was an experiment made in August, 1876. The transmitting instrument was in Paris, Ontario; the receiving instrument, the Centennial iron-box receiver, was in Brantford, at a distance of eight miles from Paris; and the battery on the circuit was in Toronto, about sixty miles away. So we had a circuit of somewhere from sixty to seventy miles. The transmission went one way only, but speeches were transmitted, and that was the first time speeches were transmitted between persons at a distance of several miles. But it was only one way; the person at the other end could not reply, but had to telegraph back by another wire. But by August, 1876, quite a number of experiments that attracted attention were made on the wires of the Dominion Telegraph Company. There was one experiment between Brantford and Mt. Pleasant, a distance of about five miles, and then I gave an exhibition from my father's house at a country place, four or five miles from Brantford, known as Tutelo Heights. It was about a quarter of a mile from the house to the nearest telegraph line. We got a lot of stovepipe wire—cleaned the town out of stovepipe wire—and took the wire off the fence from my father's house to the corner of the Mt. Pleasant road, and attached it to the telegraph wire leading into Brantford. Then I had some friends in Brantford who spoke, sung and recited into the membrane telephone, while a large number of guests at my father's house at Tutelo Heights listened to the transmission; and on that occasion also three voices were transmitted simultaneously. I had three mouthpieces made for the membrane telephone and three persons sang to the same telephone.

So those experiments at Brantford were the first experiments that were really successful in transmitting speech from one place to another at a distance, but they were all one-sided, not reciprocal.

On October 9 occurred the first conversation by telephone between persons separated by miles of space. This was on the Walworth Manufacturing Company's line, connecting its factory in Cambridgeport with the office in Boston. It was not a very long distance, probably two and one-half miles, but free communication was carried on, and I think that was an historical occasion. Mr. Watson was at one end of the line and I was at the other, and we kept a record of what passed. I noted what I said and I noted what I thought I heard him say, and the parallel columns were reported in the newspapers, especially in the Boston *Advertiser*, Octiber 19.

And so we went on during 1876 with experiments, trying to increase the distance at which results could be obtained. For that purpose the Cambridge Observatory offered its services. They had a private line from Cambridge to Boston for transmitting time signals from the observatory. I had it connected with my laboratory, and by night made experiments between the Cambridge Observatory and Boston, trying to ascertain the conditions fit for telephone service on long lines.

Then came a really noteworthy series of experiments on the lines belonging to the Eastern Railroad Company. An experiment was made on November 26, 1876, in which conversation was carried on between myself, in Boston, at the Eastern Railroad depot, and Thomas A. Watson, in Salem. We had increased the distance to eighteen miles. Then we experimented on a line that led to North Conway, 143 miles away, so that Salem was a way station to North Conway. That was a very notable extension. Mr. Watson went up to North Conway with a stack of apparatus with all sorts of modifications. I think that was really the most important experiment that had been made in connection with the free commercial stage. This experiment was on December 3, 1875. Then we tried varying the coils, trying small wire, thick wire, long coils, short coils, tried it with and without a battery; and as a result of the experiments we gave up the battery and took to the magneto telephone alone.

That takes us up to the end of 1876. There is hardly anything more I can tell you about it before it came into commercial use. On January 31, 1877, there was an experiment here in Boston that attracted

a good deal of attention at the time, although it did not compare with the other experiments in importance. It was a communication between the rubber shoe factory and the residence of Mr. Converse in Malden, but it attracted a great deal of public attention to the telephone. On January 21 there was a public exhibition on the line of the Eastern Railroad, in which no battery was used. Conversation occurred between Boston and Salem; and by and by, at about that time, in the early part of 1877 or the end of the year 1876 a rather interesting circumstance took place. I had among my students at Boston University a young Japanese student named Tsawa. He came to me for the purpose of studying the pronunciation of English. Of course, when he heard about the telephone he became very much interested. He said: "Mr. Bell, will this thing talk Japanese?" I said: "Certainly, any language." He seemed very much astonished at that, and said he would like to try it. I said that he could try it, and he went to one end of the circuit and I stood at the other. He talked Japanese, and I reported the result to him. He asked if it talked Japanese. I said: "It talked Japanese, but I couldn't quite understand it." He was not quite satisfied with that, and asked permission to bring some Japanese friends of his from Harvard College. I said: "Certainly." He brought two young men there, and they talked through the telephone and listened; so that Japanese was the first foreign language that was spoken over the telephone. These two Japanese were exceptional men. I did not know who they were at the time, but years afterwards it was revealed to me. I was in Japan, in Yokohama, when the American residents in Japan were giving a banquet to the new Japanese minister who was going to Washington, Mr. Kamura, now at the head of affairs in Japan. I was asked to attend the banquet, and instead of being introduced to Mr. Kamura he came up to me and said: "I don't require an introduction to Mr. Bell. I knew him years ago." And he turned out to be one of those Japanese students. Then I found out about the other one in a rather curious way. The Japanese government sent to this country at the time of the Russian-Japanese war Baron Kaneko. He came to Washington and gave a lecture before the National Geographical Society. I happened to be president of that society at the time. When the dinner was over and the time for the speaking came, Baron Kaneko said: "I knew Dr. Bell years ago," and he told his story about the use of the telephone. So those two men, the foremost men in Japan today —Baron Kaneko and Mr. Kamura—were the two men who heard the telephone in the winter of 1876-1877.

On February 12, 1877, I gave a lecture before the Essex Institute in Salem, Mass., and the lines were connected with Boston. The speech was transmitted between Boston and Salem, and the audience generally could hear the sound of the speaker's voice, while those who came close to the telephone were able to converse with Mr. Watson in Boston. At the invitation of the Essex Institute this lecture was repeated on February 23, 1877, and admission was charged; and on this occasion the proceeds were presented to me for my lecture on the telephone. I immediately went into Boston and we had a little silver telephone made, and it is interesting now to look back upon the fact that that was made from the first money made from the telephone.

On that occasion a very interesting incident took place. A Boston *Globe* reporter had the brilliant idea that he would send a dispatch to his paper in Boston by telephone, and on that occasion the first newspaper dispatch ever sent by telephone was sent to Boston by the Boston *Globe*. That, I think, more than anything else, woke up the press of the world to the advantage of the telephone. That article in the Boston *Globe* was copied all over the world and had a great influence in modifying public opinion.

On April 3, 1877, we talked perfectly freely between Boston and New York. On April 5, 1877, there was a lecture in Providence, R. I., which was attended by a great many people, and speech was transmitted to Boston from Providence, and a bugler in Boston, who was well known in Providence, played, the sound being heard all over the large hall in Providence, R. I.

On April 4, 1877, was opened the first telephone line specially built for telephonic purposes. It simply connected the office of Charles Williams, Jr., in Boston, with his house. It was a short line, but it was the first of the hundreds of thousands of miles of telephone wire that has since been laid.

Indiana Board Opposes Indianapolis Merger

The Indiana Board of Public Works has notified the presidents of the Indianapolis Telephone Company and the Central Union Company that it is opposed to their plans for a merger on the terms outlined in a franchise submitted a few weeks ago. The board did not go into detail, but the chief objection was to the schedule of rates, which would have provided for an increase of at least 50 per cent for telephones. It is claimed the business district secures a concession in rates at the expense of residence telephones.

The Central Union has an interminable franchise with no limitation on rates, but it agreed to give up its franchise if it was permitted to absorb the independent plant. The latter is alleged to be in control of the J. P. Morgan interests. Under its franchise it was to have spent $500,000 for improvements. The board objected to the proposed franchise because it did not provide sufficient protection for the independent lines out-state that are largely dependent on the Indianapolis company for long-distance connections. There was a provision also about limiting the net income of the merger company to eight per cent. The board thought the provision too ambiguous.

It is not known whether the plant for a merger will be renewed. The board has given the independents until July 1 to show what they are going to do toward complying with the order for improvements.

Investigation of Utility Regulation

An investigation to determine the extent to which regulation of public utility companies may be carried on without unduly interfering with their management will be conducted by the National Civic Federation, under the direction of Dr. John H. Gray, professor of economics at the University of Minnesota, who has made a number of special investigations for the United States Bureau of Labor. The investigations will cover telephones, steam and electric railroads, water, gas, electric and water power companies. A complete compilation of all the public service laws of the United States (both federal and state), Great Britain and the Dominion of Canada is now in progress.

Depreciation of Telephone Plants

By Dr. Burke Smith *

REPLACEMENTS (RENEWALS).

PHYSICAL plant begins to deteriorate, in general, immediately it is put in service, and in time requires replacement. In some cases physical plants have a certain salvage value or serviceableness after removal, either as junk in a disintegrated condition, or as serviceable plant to be used over again. When the salvage value is subtracted from the original cost in place, we have the wearing value.

Various causes combine to bring about the replacement of physical plant. Brief mention may be made of the following:

1. Normal wear and tear. In order to keep the plant in good working condition repairs, changes and replacements of small parts are necessary, and are usually included under the term "current maintenance."

2. Decreptitude or gradual deterioration, due to natural and usual causes.

3. Obsolescence or depreciation due to improvements or changes in the state of the art. Obsolescence may be due to invention or other demands which call for abandonment of plant which has not lived to the end of its usefulness. In the telephone field, obsolescence has been a very large factor in expenditures for replacements in the past, and continues to be a large factor at the present time, owing to the rapid development of new and revolutionary inventions and methods and lack of standardization.

4. Inadequacy, or inability to meet the increased demands of service in an economical or convenient manner. Inadequacy may be due to more rapid growth than could be foreseen. Public utility companies are required, by the police power of regulating bodies, to provide adequate means for giving service and in the case of a telephone company, in order to have the proper facilities to take care of future demands and build its plant economically, the direction and rate of growth of business in the territory which it covers must be anticipated many years in advance. Any substantial deviation of actual growth from anticipated growth, either in the general number of stations or in the number of stations in a particular locality, will mean either idle plant or inadequate plant. The telephone business is unique among public utilities in that there is little overload capacity. The plant must be built to take care of all emergencies.

5. Municipal requirements and legislation. With telephone and other companies occupying public property, replacements due to such causes are often large in amount and may come when least expected.

6. Damage by extraordinary occurrences, such as accidents or the forces of nature.

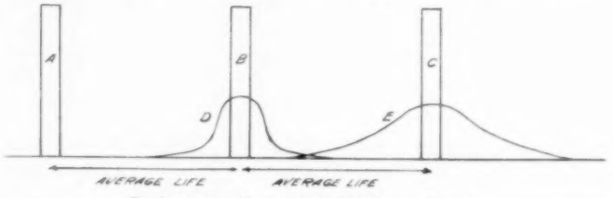
7. Deferred maintenance, or depreciation due to neglect. Under this heading may be included neglect resulting from strikes.

8. Combinations of competing companies, which result in duplication and consequent rearrangement of plant. Such rearrangement of plant may properly be regarded as supersession, rather than replacement. However, it has an effect on the average length of service of the plant as a whole.

The term "life" as ordinarily applied to physical property has two meanings, which should be carefully distinguished from each other.

a. The natural life, or length of time which elapses from date of installation to date of replacement, the replacement being made necessary through physical decay or decreptitude or normal wear and tear.

b. The average life, or length of service from the date of installation to date of replacement as determined from past experience and observations on plant installed and in actual service. It may, perhaps, be defined more accurately as the most probable length of service, taking into consideration some or all of the above causes, as well as local conditions which may bring about replacements. The available life tables of various kinds of electrical apparatus and material made up by different engineers and commissions differ widely. This especially is true of life tables of telephone apparatus and material.



Replacement Curve for Telephone Plants.

It is due, in part, to a use of the term "life" to mean, in some cases, the natural life and in other cases the life without regard to the effects of obsolescence or inadequacy. Other causes are lack of standardization in manufacture of apparatus, difference in amount and character of maintenance among different companies, and, in particular, lack of sufficient data in regard to length of service of apparatus and material which has been installed in the past.

When considering the question of replacements, the term "life" should mean the average life, taking into account all of the factors which may make replacements necessary. Some of these factors have too often been omitted in dealing with the subject of depreciation. From the meaning of the term "average life," it is evidently impossible to give a figure for the average life of the various classes of plant which is more than an approximation. Furthermore, replacements of small units or small parts will begin immediately after installation. For example, some telephone subscribers' sets may have to be replaced soon after being installed, due to damage by fire, accident or necessary changes in the electrical circuit. The parts of a switchboard, such as plugs, jacks, cords, relays, wiring, etc., must be replaced in small amounts from the time the board is installed to the time it has reached the end of its usefulness. A sleet storm may make necessary the replacement of wires and poles which have been erected but a very short time; electrolysis may destroy a cable after it has been in service but a

*Abstract of a paper presented at a joint meeting of the Western Society of Engineers and the Chicago section, American Institute of Electrical Engineers, April 22, 1912.

few years. Thus replacements, due to external or natural causes, begin immediately after apparatus is installed.

On the other hand, some plant will remain in service for a longer time than the average. The tendency of this distribution of renewals over a number of years is to smooth out the curve of renewals and to make the estimation of future renewals in time and amount more difficult.

To illustrate: Consider the figure where area *A* represents the cost of apparatus installed during a given year. Then, if the average life has been determined, say, approximately ten years, the areas *B* and *C* will represent in theory the first and second renewals which should take place. In actual practice, renewals will begin previous to ten years and some of the apparatus will remain in service for some time after the ten-year period. Suppose, for example, that the curve *D* represents the law which the replacements actually follow, the area under the curve being equal to the original area *A*. Then, assuming that the same law holds for the replacement of the plant which takes the place of that first installed, the second replacement will be represented by the area under curve *E*. Since some apparatus will have been replaced three or four times, and all apparatus will be replaced twice, the curve *E* will have a tendency to spread out over the greater number of years and enclose more area than the curve *D*. In other words, in actual practice the amount of renewals necessary in a given period will be different from, and may be greater than that which is indicated by assuming that the entire replacement takes place at the end of the average life.

COMPOSITE LIFE OF PHYSICAL PLANT.

In order to treat a composite physical plant as one unit without regard to the separate units of plant of which it is made up, it is necessary to consider its composite life. This may be defined as a period of years such that the total deterioration of the plant during this period will amount to the wearing value of the plant as a whole. The deterioration of plant in this sense includes both replacements and depreciation of existing plant. The composite life has no physical meaning in the sense that the plant will come to the end of its life at the end of the period and that we would consequently have an entirely new plant immediately following this period. It is, however, a convenient way of expressing the effect of depreciation occurring in the plant as a whole.

The estimated amount of deterioration during a period should be the same whether obtained by taking into account each separate class of plant, together with its average life, or whether obtained by taking into account the plant as a whole. The actual replacements, however, which will come due at any given time, assuming that the average lives of the different classes of plant are known with some degree of accuracy, can be more closely estimated by using average life figures for each class of plant rather than using the composite life and treating the plant as a whole.

A comparison of the estimated composite lives of a number of different public utilities shows that telephone plants are much shorter lived than plants of other utilities, the average figures as reported by the Wisconsin railroad commission being something like eleven and one-fourth years for telephone plants, seventeen and one-half years for electric lighting properties, eighteen years for electric railways, thirty years for a gas plant and sixty years for a water plant.

Moreover, the composite life of a telephone plant will vary during different periods of its growth and development.

Take, for example, an established telephone company in a large city which has been in existence for, say, twenty years or more. During the first period of growth, when business was in process of development and the art of telephony was in a very crude stage, much of the plant was of temporary character. Switchboards were soon rendered obsolete and the outside plant was entirely aerial, and especially liable to damage by storms or accident.

A second period of growth includes the present. During this period the art of telephony has advanced to its present highly developed state, overhead type of construction has in a large measure given way to the underground, and growth has taken place very rapidly. Inadequacy and obsolescence have played a very prominent part in the changes which have taken place, as already mentioned. Additions to plant in different years have been necessarily made up of different kinds of plant. Thus one year, central office equipment may be the principal item, another year conduit and cable, another year buildings, etc.

A third period of growth will begin when saturation is reached. This period is, no doubt, in the remote future, but if we may speculate in regard to it, we may say that growth during this period will depend largely upon the growth of population.

The above considerations lead one to believe that the composite life of a telephone plant in general should increase with growth and development. But such an increase is by no means certain on account of the number of factor involved. For example, at the present time modern transmission standards make necessary the use of improved types of cable to take the place of old types. The semi-automatic switchboard may make advisable the replacement of manual boards in the near future. Large changes in substation equipment may be necessary at times in order to introduce improved service. Legislation and municipal requirements may be the cause of much reconstruction. The increasing number of high tension power circuits built in proximity to telephone circuits necessitate changes in location of lines or in protective measures. Other factors, such as wireless telephony and the telephone repeater, have possibilities. It is impossible to say what the future has in store for telephony, but where there is progress there is change and obsolescence.

PROVISION FOR REPLACEMENT OF PLANT.

There are three methods of providing for replacements which may be mentioned:

Method 1. Capitalize replacements. This method, if used to any great extent, is indefensible. This has been pointed out many times. It may be remarked in passing, however, that for a rapidly growing plant it may not be as disastrous as for a fixed plant, since the inflation of the plant account in the former case will be relatively smaller than in the latter case.

Method 2. This method consists in treating all replacements of plant simply as current maintenance, regardless of the causes to which they may be due. Only that portion of the cost of replacements which equals the

original cost of plant displaced is charged to operating expenses, the remaining portion being considered as an increase to the total plant. Under this method no provision is made in advance for expenditures for replacements.

This method is the usual one with steam railroads and some large street railway companies. It does not, in the writer's opinion, apply to telephone plants without some modifications, because it assumes:

First. A plant having numerous physical elements, each element forming but a small part of the whole plant. Few telephone companies in existence at the present time have plants large enough to show these characteristics. Replacement cost of switchboards, building, conduit runs, pole lines, which must all be considered in this connection as single units of plant, are examples of items which are greater than should be charged to operating expenses at one time.

Second. A plant in which replacements due to sudden and unexpected causes are comparatively small in amount. Plans which are subject to municipal requirements, inadequacy, obsolescence, or damage by storm or accident have to face replacements which may be excessive in amount and may come when least expected.

Third. A plant which has had a fairly uniform growth. The effect of a changing and rapid rate of growth is to cause corresponding changes in the rate at which the plant must be replaced.

Fourth. Earnings available each year in sufficient amount to allow an adequate sum for replacements. In every business there are prosperous years and dull years. As a matter of insurance against lack of funds for renewals, some provision should be made in advance, instead of depending upon the earnings which come in from year to year.

Method 3. This method consists in setting up a depreciation reserve fund, or "Replacement Reserve," paid in annual installments and such that the total of all contributions, with or without interest, as the case may be, will amount to the "wearing value" of the original property at the end of its life.

In some cases a distinction is made between a reserve fund for special insurance against sudden and infrequent replacements and a reserve fund to take care of continuous depreciation. It would seem that any plant which is exposed to the elements or which is liable to sudden and unexpected need for reconstruction should be protected by a special insurance fund. Also, the element of chance entering into such matters would call for an ample margin of safety.

PROPER AMOUNT TO BE PUT INTO A RESERVE.

As applied to telephone properties, it is believed that the building up of proper reserve funds is the only safe procedure to follow. Current maintenance cannot be sharply distinguished from actual replacements in a plant made up of a very large number of small units. Some of the apparatus which goes to make up a telephone plant is of this kind and replacements of such small parts may be charged to current maintenance. But in order to adequately provide for sudden and unpredicted replacements of large amounts of plant made necessary by obsolescence, inadequacy, storms, accidents and public requirements to which a telephone plant is largely subject, some special insurance in the way of a reserve fund must be provided.

It is evident from what precedes that the accurate determination of the amount of necessary renewals of telephone plant for any length of time in advance is impossible. Indeed, it is believed that an exact forecast of the amount of replacements for even one year in advance is impossible for the average telephone plant of any considerable size. Depreciation or deterioration due to such causes as obsolescence, inadequacy, changes in competitive conditions, legislation, storms and accidents, cannot be predicted with precision. For this reason the exact amount of money which should be put into a reserve fund each year to provide for future replacements cannot be easily determined. This is especially true of telephone properties on account of the number of uncertain elements which may affect the lives of the different units of plant, as already noted.

One method of estimating this amount is based on an estimate of the composite life of the plant. According to this method, if the composite life of the plant is estimated to be n years, then $\left(\frac{1}{n}\right)$ of the total wearing value of the plant should be put into the reserve each year, assuming that the fund will earn no interest. If the fund earns a given rate of interest, the amount to be put into the reserve each year will be less. Assuming that the fund will earn no interest, it may be shown that this method is equivalent to taking the life of each separate unit of plant and calculating the total sum which should be put into the reserve in order to properly care for all the separate units.

The importance of a proper reserve fund in the case of many such companies was not recognized in the past and an adequate reserve does not exist at present. For such companies there are at the present time two distinct problems; first, the determination of the proper amount which should be in the reserve at the present time in order to properly take care of replacement of existing plant when it comes to the end of its life. Second, the determination of the proper amount which should be put into the reserve to take care of the replacement of new additions to plant from year to year.

The second problem is, perhaps, more capable of solution than the first, since in the case of yearly additions to plant we are dealing with entirely new plant with the experience of the past to guide us, and the accounting system may be arranged to enable us to revise our estimate of depreciation from time to time. Even then the best we can do is to use our judgment and draw on past experience as much as possible in making a reasonable forecast of future life.

In regard to the first problem, it may be proposed that we should fall back on an appraisal. But one should not overlook the fact that however well we may be able to estimate the present condition or depreciated value of existing plant and however well we may be able to estimate future life based on present physical condition, no one is able to estimate the effect which obsolescence, inadequacy, public requirements and the forces of nature will have upon the future life of existing plant. Judging from past experience in the telephone field, these factors will have a much greater effect than normal wear and tear or decrepitude.

It has been claimed by some that in the case of an old established plant which has been in service long enough to eliminate the effects of the first period of

growth and development of business, and where the plant has reached its normal operating state, the amount which should be put into the reserve may be estimated approximately by averaging the cost of replacements for a period of years in the past. That is, if a company operating today finds that annual renewals, aside from current maintenance, have averaged, say, 3 per cent of the total investment in the last five years, then 3 per cent should be enough on the average to care for renewals in the future.

On account of the rapidity of growth of every telephone company of any considerable size in the United States and other reasons, it is believed that in hardly a single instance will the future replacements be reflected in the present and past reconstruction accounts in this way. Estimates of the composite life of telephone plants in large cities, obtained from different sources, vary between eleven years and fourteen years. Assuming a salvage value on the plant as a whole of, say, 15 per cent, this would mean 7.7 per cent to 6.1 per cent of the total investment as the proper amount on a straight line basis to put into the reserve fund each year to provide for future replacements. It does not follow, however, that renewals in a properly maintained telephone plant should average as high as this at the present time. During the first few years of existence of a new and growing plant the cost of renewals will ordinarily be small.

If adequate funds are laid aside for future replacement of plant under the sinking fund method, a considerable amount of money may be accumulated in the beginning years of business before renewals begin to assume large proportions. And if the plant is a rapidly growing one, this excess reserve fund may continue to increase, since renewals form a smaller percentage of the investment than is the case in a fixed plant. A large reserve fund should not influence those having in charge the responsibility of providing for the future to cut down the rate at which the reserve is accumulated, provided this rate has been determined by a careful forecast of the future life. If such funds are certain to be needed at some future time, they should be accumulated in advance, so as to be available when the occasion for their use arises.

A lack of appreciation of these facts, both by the public and by public utilities, no doubt has had much to do with inadequate reserve funds in the past.

In conclusion, it is desired to emphasize three points which the above example and that of many other companies operating today will substantiate:

First. In a telephone plant which is growing rapidly and is some ten or twenty years old, annual replacements should be small as compared with those in a fixed plant.

Second. In an average growing telephone plant today replacements should form a steadily increasing percentage of the total investment and should in time approximate the amount which would be expected in a fixed plant.

Third. The fact that replacements in a growing plant are a comparatively small percentage of the total investment is not a valid reason for lessening the amount of reserve fund which a study of the conditions would show is necessary for future replacements.

A telephone system will be installed in Nikolaiefsk on the Amur, Siberia, during 1912.

Maryland Commission News

The Maryland Public Service Commission held a conference recently with representatives of the Chesapeake and Potomac Telephone Company regarding new rates that have been adopted by the company and the many complaints that have been received by the commission concerning the rates and the service in general.

The company was represented by Messrs. T. P. Sylvan, of New York, and Frank S. Whitman. Although no conclusions were reached it is believed that as a result of the conference several changes in the rates may be made.

The schedules were fully explained by Messrs. Sylvan and Whitman. It appears that much of the confusion existing between telephone subscribers is due to the interpretation that has been put upon them by the solicitors of the company.

The commission received a protest against the rates signed by Joel Gutman & Co., Hochschild, Kohn & Co. and Hutzler Bros. These request that they and all other users be allowed to purchase telephone calls in blocks of 900 at two cents per call after the number of calls provided for in the contracts has been exhausted. They also assert that it is a hardship to be obliged to contract a year in advance for a specified number of calls.

Growing out of dissatisfaction with telephone rates in Baltimore and vicinity the Protective Telephone Association of Baltimore, just organized, is making plans for obtaining lower rates for such service and committees are gathering data and enlisting members.

The association is intended to be the recognized bureau for complaints so that presentation to the telephone company or to the Public Service Commission will be made after due investigation.

New Jersey Commission News

Philander Betts, an expert employed by the New Jersey Public Utility Commission, was the sole witness in a case brought by Gately & Hurley and other merchants of Camden against the Bell Telephone Company, in an effort to have rates for service there declared excessive.

Betts' testimony was important in that he set forth what he declared to be the real basis for computing value of plants from which reasonable service rates can be computed. After his testimony was given adjournment was taken for six weeks, when final argument will be had.

Betts held that something must be subtracted from the value of the Camden plant for the years during which large returns were obtained for service and nothing laid by for depreciation. He held that in the early days, before the telephone plant in Camden was put on a modern financial basis, which included the laying aside of moneys for depreciation and for extensions, large dividend returns were given out to the stockholders. In this way, he declared, some of the actual value of the plant was paid out, and he contended that this value must be determined and become a factor in establishing the correct rate to be charged to subscribers based on the earning capacity, the value of the plant and the usual additions and subtractions for extensions, depreciation, etc.

What One Woman Thinks

By Sarah Elizabeth Brown

HAPPY days—I can now refer to "last winter." Two things occurred last winter—the winter itself, which left me with a frost-bitten toe on my left foot—and the heavy editorial thunder about the year 1911 in retrospect. How miserable we were in the gloom of things! But here is spring and sunny days and near new vegetables. We are a wonderfully impatient, energetic and forgiving people. Last winter was a terror in many ways. We may forgive, but we won't forget it—that is, right away, for out here we've lost our winter wheat! But what about 1911 in retrospect? We were led to believe that 1911 was a period of "marking time" and the prophets also told us that there would be no change until after the presidential election in 1912 and may be not then. There wasn't a ray of hope. Everything was draped in mourning and everybody was wearing black. Telephone men believed it with their spindles stuck full of unfulfilled orders for additional service. They drooned over their trial balances and closed their eyes to a satisfying bank balance and wouldn't spend a cent. Then they hurried out and bought Christmas presents in a perfectly scandalous way and jumped into their January inventories. Nobody said a word. Nobody told their findings. Nobody smiled. Nearly everybody sent out orders for something and marked the order "rush." Everybody got busy at once and more orders followed. The upshot of this activity is clear to the rankest pessimist and one of the cold-blooded historical truths as it affects the telephone business as a whole is now to be set down in simple words, thus: More real money has changed hands since January, 1912, to date, than ever before in a like period. Spring has brought us many blessings. It has brushed away the gloom. May flowers will not be more beautiful than the joy attending telephone affairs in general. And it is my notion that presidential election will cut no ice.

* * *

The U. S. I. affair, which I refer to now and then, has not only reached the court, but it seems to have gotten into the New York papers. I find, through the latter, that the Court of Appeals has held—as it respects this particular case, at least—that persons who invested in the bonds of a corporation, relying upon the propectus containing misleading statements concerning its properties, are entitled to recover the money so invested. It has also held that the men behind the company, were responsible for the misrepresentations, though they were not put forth by them, but were signed only by a promoter acting as agent for the sale of the securities. My brothers, I am not dreaming. This isn't my dope; it is the Court of Appeals. Read it over again and then rub your eyes and pinch yourself. That's what I did and it is the best way to come out of it quickly. Think of it! If this decision can be made to stick the U. S. I. bubble will have been a most useful enterprise, because it will have set up in the statutes a precedent that will safeguard countless millions of investment. It is a habit of the promoter to include the names of influential men upon its prospectus roster. When the court finds that these men are to be held for the sins of the promoter, this world will be a safer place to live in. We all know that the names of some of the most respectable and influential financial men of Rochester were included in the U. S. I. literature. They represent enough money to reimburse those who were unfortnate enough to invest in U. S. I. securities. Possibly some of these men put their own money into the enterprise, but you and I know the promoter too well to imagine that the big 'uns did'nt get something for their names. However, the court says they are liable, and the dishonest promoter has made them suffer. It is unusual to lose your own money and then have to pay somebody else for losing his along with you, but in this case the men who lose are able to lose and they have the satisfaction that their experience will foster sounder financial methods. Maybe the old U. S. I. affair was a big blessing in disguise.

* * *

Talk may be cheap, but it is costing about three-quarters of a million dollars a day to put a little of it through the telephone systems of the United States. This doesn't include intercommunicating systems and the farmers' lines. If the statistician might tabulate the total cost of telephonic conversation, a million dollars a day wouldn't cover it. And to think that nobody ever mentions the saturation point since Paul Latzke went into the discard!

* * *

Frank Woods is quietly amalgamating everything south of the Platte and east of Kearney and Franklin counties in Nebraska. He has recently taken over the system at Fairburg, one of the most successful of the independent operators. Mr. Woods, representing the Lincoln T. & T. Co., has agreed to pay par for the Fairburg Telephone Company's stock and accrued dividends. It is reported that the stockholders agreed to the proposition by an "overwhelming majority."

* * *

It is alleged that the Western Union Telegraph Company is establishing agencies among the Bell telephone subscribers of Philadelphia, offering pay on a commission basis for telegrams sent to the telegraph company over telephone lines. The Western Union representatives are busy establishing agents, so it is said, among the hotels of the city. The contracts offered call for the payment of ten per cent for such business—all of which occurs to me to be perfectly legitimate and proper, inasmuch as the same interests own both the telegraph and telephone companies. Owners usually elect to do about as they please with their own property. But the practice has stirred up the rival operators in our beloved *Ladies' Home Journal* town and government officials are supposed to be hot on the trail of the agents in the hope of finding certain infractions of the anti-rebate law. These officials are not so much concerned with the hotel arrangement, which will give the Western a slight advantage over the Postal, but they are looking for what is regarded to be the inevitable—an extension of the practice to include business houses whose accounts

run into the hundreds of dollars a month. The hint has been thrown out that the government line of inquiry is being directed to the point that the Bell and Western Union are by this method attempting to create monopoly in violation of the Sherman Act. I am no judge, but if a fifty-cent telegram can be scalped five cents in favor of a telephone, I'm for that. And another thing in passing. I positively detest that word "monopoly" as applied to the telephone business. Let's adopt that better word—"unity."

* * *

So the Swedish-American Telephone Company is a bankrupt. I have read the notice and it sounds pretty much like a funeral service. One building, so big; another, so big; good-will, tools, machinery, unfulfilled orders and all that, offered to the highest bidder by a trustee appointed by the court. I'm always sorry for those who suffer or fail. This failure removes an independent telephone manufacturer from the competitive field. My notion of why the company failed wouldn't interest many people. I never saw E. B. Overshiner but once and he was busy at that time explaining the merits of an automobile in the parlors of the Auditorium Hotel. I learned that the room cost him a hundred a day and that he didn't care. The automobile didn't impress me much. Our farmers use better cars to haul their milk to market. I have also heard that this same Overshiner has been busy as a promoter, including most lines from publishing to manufacturing, including the making of vibrators, vacuum cleaners, amusements, wagon beds and Canadian plants. His activities were varied. The telephone business retrograded from first to something like last. The inevitable followed. I think it was Fred Weyerhaeuser, that St. Paul lumber king reputed to be worth more than Carnegie or Rockefeller who said: "Work can be made a joy, an economy, a pleasure, if you combine an object worth while with the determined ambition to win." You will observe that Mr. Weyerhaeuser uses the word object—not objects. The manufacture of telephones is a good business, all by itself. That has been proved by the men who have stuck to the line. Too many cooks to the broth; too many irons in the fire; too many chicks to the hen spells disaster. The head of the Swedish-American Telephone Company may have realized all this when it was too late.

* * *

Several weeks ago a tiny little notice tucked away in an obscure corner of my favorite newspaper told about the Pacific T. & T. Company purchase of the San Francisco Home. I couldn't believe it. Why would the Bell buy that big, magnificent automatic property? I find that the little notice was very much a fact. I learn now that the general offices of the Bell coast operator are in the Home building and that the Bell is operating the automatic plant serving about 15,000 subscribers. The Home represented an investment of about $12,000,000. The story was told in the columns of this paper. It was a beautiful example of independent enterprise. President Frick of the Home company says that last year the property paid the operating expenses and 1 per cent on its investment, without allowance for depreciation. The Bell paid $9,275,000 for the plant. Part of the payment was in its own preferred stock and part in new bonds of the Home Long Distance Telephone Company.

South Dakota Commission Authority Questioned

Questioning the authority of the state railway commission to enforce its order regarding the switching of a rival telephone company over its switchboard, the Beresford (S. Dak.) Telephone Company has entered a demurrer before Judge Jones in the circuit court to the complaint of the commission that the company has not complied with its order.

The North Star Telephone Company, which is a rural concern and operates in the vicinity of Beresford, and has three lines running into that city, entered complaint with the board of railway commissioners on January 14, 1911, against the Beresford company.

It alleged that while it has a switching arrangement with the Beresford company and that company will connect a subscriber of the North Star company with one of its own subscribers, it will not connect a subscriber on one of the North Star lines to a subscriber on another line of the same company.

The board, in its findings of fact and law handed down May 23, held that the companies were competitors, but that the North Star company only leased one phone to each of its stockholders and to no outsiders, and that the Beresford company should, therefore, do the switching for the North Star company at a cost not to exceed 25 cents per telephone per year.

The commission now alleges that the Beresford company has failed to comply with its order and asks the court to issue a peremptory writ of mandamus to compel the Beresford company to carry out the instructions of the commission.

In its demurrer asking the dismissal of the suit the defendant company denies the legal power of the board to make such an order, because it in a measure deprives the company of the control of its property.

Telephone Supplies for Malaysia

Vice-Consul General D. Milton Figart, Singapore, says that in the Straits Settlements there are now 218 miles of elegraph and 7,321 miles of telephone wire. The Oriental Telephone & Electric Company (Ltd.), operates in Singapore, and the government elsewhere. The 2,018 miles of telegraph and 3,118 miles of telephone wire in the Federated Malay States are all government owned. While the government formerly purchased some supplies from the foregoing company, it is understood that the policy is now to purchase everything through the crown agents of the colonies in London.

"Hello" Tabooed by Railroad

The word "hello" in responding to telephone calls has been tabooed by the Pere Marquette Railway. This form of answer is held to be undignified. Under a code of telephone etiquette as devised by the railway, this will be the proper form of opening a telephone conversation:

"Telephone bell rings. Take down receiver as usual. Say: 'Morton and Company, Mr. Baker speaking.' Other end of the wire, person calling, replies: 'Mr. Wood of Curtis & Sons wishes to talk with Mr. White.'

"This simplifies the whole matter," the code explains. "The purpose of the call can then be carried on as usual."

Digest of Foreign Telephone Literature

Translated for Our Readers

PROGRESS OF TELEPHONE EXPERIMENTS FOR RECEIVING SUBMARINE SIGNALS.

SINCE the famous experiments of Colladon and Sturm on Lake Geneva, numerous experiments have been made to find some means of transmitting submarine sounds by the use of a telephone and thus warn ships' officers of any approaching danger. The problem was to transmit these sounds with the greatest intensity and to the greatest distance, using the sea water as a medium of transmission. The success obtained with submarine bells made the results of these experiments seem very certain of success. Signals transmitted by water are superior in quality to those transmitted by air, because they are not subject to atmospheric changes, and can be sent at all times and to great distances. The receiver employed in the experiments is based on the telephone receiver principle. The sides of the ship, or in the case of a warship the armor, constitute the wires, since the ship's sides are influenced by the sound waves transmitted by the water. The vibrations in the steel sides result in a change of resistance in a microphone, mounted in such a way as to be influenced by these vibrations. The microphone is connected to a telephone receiver placed in some convenient place on the bridge. The observer is therefore able to determine promptly and very accurately the exact direction of the sound waves coming into the apparatus.

This telephone system has recently been adopted by the French navy after a series of tests made in the harbor of Cherbourg by the government. The apparatus as used in the navy consists of a microphone transmitter of very sensitive construction, enclosed in a box and fastened to the sides of the ship beneath the water line, connected to a pair of telephone receivers similar to the head receivers of exchange operators. The microphone receives the vibrations transmitted by means of a metal ring or disc, solidly screwed to the bottom of the box at the side of the vessel. This metal ring, whose dimensions have been accurately determined, possesses great resonance qualites of such a type that it cannot enter into sympathetic vibrations, except those occasioned by the submarine bell. The frequency of vibrations is set so as to be most suitable for the transmission of the sounds. The utilization of the resonance phenomenon adds to the loudness of the submarine bell sounds, since the sounds emitted by the latter are amplified by the resonance.

Every ship has two such instruments, one on the starboard and one on the larboard side, and the operator can connect his receivers to either instrument by means of a small switch. It is thus possible to compare the intensity of the sounds from both sides of the ship. In changing the course of the ship until the sounds emitted by both sides are equal, the threatened danger can be avoided, or else by changing the direction in following the stronger sound, the source of the sound can be found.—*L'Academie des Sciences.*

OPERATION OF TELEPHONE EXCHANGES.

Strictly speaking, operation of telephone exchanges embraces all means taken to assure permanent and uninterrupted telephone service for the subscribers. We may differentiate in the main between two factors, namely the inventory, embracing the telephone exchange equipment, and the operating staff. The former must be looked after continuously to see that wires, switchboards, and all the electrical and mechanical parts of the plant and the connections between exchange and subscribers are always in proper shape. The care of the second is just as necessary, for, unless proper care is taken of the comfort of the operators, more so since they are with but few exceptions women, the service will not be at its best and the operators cannot give the highest efficiency. Aside from the hygienic side of the problem, which is of supreme importance, we have the more technical side, which embraces the proper adjustment of operators, so that all of them will have as equal a load as possible during the rush hours, and prevent the overburdening of a few operators. The latter problem depends on the number of operators available and the nature of the service, as for example the time of the largest number of calls, duration of the individual calls, and other connected matters. The usually very fluctuating number and rate of calls during the day would demand a constant change in the number of operators, so as to respond to the continual change in demand on the exchange. This adaptation of service to subscribers' demand is probably the most important and the most difficult problem awaiting the solution of the manager. If we view the course of a day's work under normal conditions we will see that after a low night service, the demand increases slowly at first during the first few morning hours, rising rapidly after that and reaching a maximum number of calls about the middle of the forenoon. During the lunch hour the calls decrease again to a minimum, to rise again during the afternoon to a number which is slightly smaller than the forenoon high-water mark. The service then decreases down to a minimum at night. Let us see how the usual exchange handles the situation.

In a long, narrow switchboard panel we have the horizontal parallel lines of subscriber call lamps set into the vertical switchboard. One telephone operator gives service to about 100 to 150 of these subscribers. The operator answers the calls, makes the proper connections, and disconnects after completed calls. If the subscribers were to call in at intervals of about twelve seconds, the operator would make about 300 calls in an hour; in other words, she would be busy without interruption. Every one of the subscribers in this switchboard panel would have made about two or three calls within the specified time. If the number of calls coming into the exchange increases, a delay would be occasioned unless some other operator can take up the surplus of work at once. That can only be done, however, if the operators on either side of the busy operator are not busy

and have therefore time to answer her calls. The conditions under which efficient and uninterrupted service can be given by the exchange is evidently that in which no more than 300 calls come in per hour to one panel of the switchboard.

There is only one way to reach the desired end; that is, to divide the switchboard service at the exchange in such a way that every fluctuation of the incoming number of calls is met by proper service. and also to utilize every switchboard panel to the maximum possible point. This means is the intermediate distributing board. As soon as some switchboard panel is overburdened by the number of calls, and thus threatens to destroy the equilibrium of service at the time, the intermediate distributer comes into play and relieves the strain on the operator in question.

The effect of this distributer service depends evidently on the accuracy with which the daily service has been studied, the character of service of the different lines and the frequency of use of the same. American exchanges have to a large extent used this means to meet the required service. The change to the intermediate distributer service is employed almost daily in some of the exchanges, but the question is whether the detailed study of the problem, the amount of work necessary to determine what lines to switch to the intermediate board, is not so much as to eliminate all the results obtained by this system. It is not enough to have the exchange adapt itself to changing conditions every hour, but it ought to be able to meet changing conditions at any moment.

If we take a short glance at the effect of such a system, we find that the size of each switchboard panel is not determined by the maximum numbers of connections to be made during rush hours, divided by the average number of calls which cannot be answered by one operator, but has to be split up among several operators. The panel is arranged according to the maximum number of calls divided by the maximum number of calls that cannot be answered by the operators. In an exchange with about 9,000 connections, taking the standard of 300 calls per hour, the desired number would be equal to $\frac{9000}{300}$=30 operators or ten jack panels. It is obvious that it will be easier to adjust the number of operators during the quiet parts of the day to the service, the smaller the entire jack panel is kept.

As to the means to this end, it is plain that no use can be made of any manual operations in switching busy lines to free lines, nor can an intermediate distributer system be used. Only a mechanical device, doing continuous work, can do this work of the intermediate distributer, and the work of this device can perhaps be illustrated by the following analogy.

If we consider every call reaching the intermediate distributing board as a ball, which contains the number of the desired subscriber, we can get a good picture of the process in operation. The ball passes near the intermediate distributer into a tube which sends it flying past all of the operator's places, each of which has a valve leading into a branch tube, ending at the operator's seat. The valves are open when the telephone operators of the corresponding places are free to receive calls, and closed when the operators are busy. A ball sent into the tube will pass along the lines of operators until it reaches an open valve, through which it will pass and fall into the tube ending at that operator's seat. The operator receives the ball (the call) and in doing so, closes the valve between the main and branch tubes, so that no call can reach her while she tends to this one. The machine cannot give the operator any new call until she is through with the first one. The intermediate distributer is seen to be useless with such a device. In reality the machine is an ordinary distributer of simple design, the tubes are wires, the valves contacts, and the call comes in the form of electric current instead of a ball.

An exchange using two operators from ten o'clock at night to six o'clock in the morning shows that about 1,600 calls were made during these sixteen hours of operator service (eight per operator) making about 100 calls per operator's hour. One operator would have been sufficient if it were not that the call lamps and switchboard panels are distributed over such a wide area that constant running back and forward along the boards is necessary to answer calls. In the same exchange during the time from six o'clock in the morning to ten o'clock at night 86,600 calls were received, an average of 213 calls per operator-hour. Using the mechanical distributer, the number of jack panels could have been reduced considerably, and with a constant call number of 300 per operator-hour, the service could have been operated at the rate of $\frac{86,600}{300}$ = 289 operator hours. The saving in operator's hours would have amounted to 106 operator-hours. In addition to the saving on the part of the operators we would have the saving of work on the intermediate distributer board, which is not necessary.

Taking every call to a free operator has an an added advantage in the fact that the one sided condition whereby the operator can reach every subscriber, but not the subscriber every operator, is eliminated. The result is that aside from the saving in strength on part of the operating staff, the exchange equipment is utilized to a greater extent. This is of some importance as telephone practice has shown that only a slight percentage of the total number of jacks and cords in switchboard panel is utilized to any advantage. The very fact that service is made simpler and more efficient, as also less severe for the operator, would seem to be an indication of the value of such a system.—*Zeit. f. Schwachstrom-technik.*

SECRET CONTROL OF BERLIN TELEPHONE SERVICE.

The Berlin telephone exchanges have recently started a secret service which is to subject the telephone service of that city to a permanent secret control. The effect of that service is expected to have a marked improvement on the service. The control station is in a separate building and is connected to all the exchanges by the usual wire service. The exchange wires end at the control station in a number of specially constructed switchboards, and in the exchanges at a multiple switchboard, where connections can be made with any operator in the exchange. The control station determines what exchange is to be inpected and sends an inspector each day to the various exchanges to test the service not only on the part of

the operators but also from the equipment side. As these inspectors are sent out in secret no one, not even the chief telephone operator or manager, knows when the inspector will arrive. The result is that, although only a comparatively small portion of the city's exchanges can be controlled each week, the rest of them are kept in such a state of expectation and uncertainty that they will do their best, not knowing when the inspector will appear. To prevent the operators from knowing when an inspector is listening in on her service, the telephone instruments, cords, contacts, etc., have been designed in such a way as to avoid the faint clicking noise that would tell the opening of a line and watching of service. The switchboards at the control station have signal lamps whose rapid or slow lighting shows the speed with which the operators answer calls. The inspectors can also cut in on the wires and listen to the talks of operators and subscribers. Every impolite answer on the part of the operator, wrong connections, slow work, etc., are noted down at the station, and the observations made in connections with the different exchanges are sent at the end of the day to the corresponding exchange with advice as to the remedy of such conditions. An added service will be the control of the telephone connections proper, which are often subject to interruptions and noises which may only last for a few minutes at a time, but are nevertheless disagreeable. Often these interruptions will not show when the line is inspected, and the control station is to be connected with any such lines that show these symptoms for the purpose of constant watching until the fault is located. It is to be hoped that the installation of this control service will increase the efficiency of the Berlin telephone service considerably.—*Zeit. f. Schwachstromtechnik.*

WIRELESS TELEPHONY ON BOARD SHIP.

The laws passed by the United States, Austria and Italy demanding that all steamers and ocean-going ships carry wireless outfits have called forth quite a little attention in German naval and marine societies and interests and have brought up the question of the application of wireless telephony in connection with wireless telegraphy. Successful trials have been made in telephoning by wireless between Berlin and Copenhagen, and the question is whether wireless telephony could not be used on ship as well as on land. A short synopsis of the field and the questions involved may not be out of place in view of the importance of the question.

Fessenden, in 1906, was able to communicate by wireless telephony between Brant Rock, near Boston, and Plymouth, a distance of 10.8 miles. In 1907; however, this distance was increased to 200 miles, and in 1910 Fessenden claims to have used the wireless telephone for a distance of 425 miles. He hoped to increase the distance to 3,000 miles, and intended to erect wireless telephonic communication between Scotland and Massachusetts. In Germany Ruhmer was also busy on the same problem and increased his distance from 24 miles in 1906 to 66 miles in 1910. The first ships to be equipped with wireless telphony were American warships. Just before the American fleet began its world cruise under Admiral Evans, 16 battleships, 6 torpedoboat destroyers and 6 cruisers were equipped with wireless telephones. The instruments proved very effective and satisfactory, but did not reach a distance beyond 40 miles. While this distance is not very great, it shows, nevertheless, that the system can be used with great advantage for intercommunication between ships of a fleet or squadron, and in that line wireless telephone systems are more advantageous than wireless telegraph systems. The inventor claimed that the more or less negative results with the apparatus were due to the inexperience of the operators; it is more likely, however, that it is due to the faults of the instruments, which are still in a stage of development. De Forest since then has worked out a new system, whose transmitting apparatus needs no specially trained operator, since it does not have movable electrodes and is similar to the ordinary transmitter. The tests made on the cruiser "Furious" proved this system to be effective up to a distance of 60 miles. The De Forest Company then made arrangements with the Metropolitan Life Insurance Company to install a wireless telphone system for a distance of 300 miles. The project of communicating between New York and Paris is now under way.

A great advance in wireless telephony was made with the invention of the hydraulic microphone, invented by the Italian Professor Majorana. With this instrument the professor was able to communicate to a distance of 255 miles. Finally we have the work of the two French officers, Collin and Jeance, who succeeded in telephoning a distance of 100 miles between warships. The French marine department then ordered the adoption of that system in the navy. Up to the present, however, and probably for years to come, wireless telegraphy will maintain its supremacy on the sea and it will take long and arduous work to bring wireless telephony to such a state of perfection that communication over long distances will be possible.—*Zeit. f. Schwachstromtech.*

RESISTANCE MATERIAL WITH VARIABLE TEMPERATURE COEFFICIENT.

Electrical resistances are usually made from iron, platinum, manganine, nickeline, Kruppine, and other alloys. All these metals, except manganine, which has a very low temperature coefficient, have a positive temperature coefficient, and are used as choke coils and rheostats. Resistances with negative temperature coefficients, which can be exposed to a permanent temperature of 500° C. without undergoing a chemical change, are unknown. The disadvantages of the materials mentioned before consist in their chemical change, due to the oxidation process caused by the passing of the electric current, and the large amount of space that they take up if they are to give proper results. After some time of usage, most of these resistances have to be exchanged and replaced by new ones. The construction of these electrical resistances and fuse wires is of some importance as they are very necessary for the proper operation of any electrical undertaking, whether it be a telephone or telegraph station or a power transmission plant. One of the best resistance materials so far has been the one manufactured by the French firm Parvillié Freres. They take nickel and mix it with quartz or caolin, adding some flux in order to prevent oxidation of the metal at high temperatures. The resulting mass is then pressed into fuse wires by means of hydraulic pressure. While these resistances are excellent at

first, they soon melt and become useless. The reason is found in the use of a base metal and in the poor contacts. The nickel used in the resistances oxidizes after a short time and forms nickel oxide, and where this oxidation has taken place, the resistances melt and become useless. Long experimental work has shown that the best resistances with proper contacts can be made from some noble metal, such as silver. The only difficulty was to find some bond between this metal and the oxides that had to be added. Metallic aluminum or magnesium was finally found to be the best for the purpose. The process is as follows: The noble metal, either gold, silver, or platinum, is powdered and mixed with a liquid silicate and some maganese compound and aluminum. The mass is then melted in a crucible at a temperature of 1,000° C. The mass is then freed of unsintered aluminum particles and pressed into the proper form by hydraulic pressure. The noble metal has a greater conductivity factor, and a lower affinity for oxygen. Tests made with resistances of this type gave a resistance of 8.4 ohms at a temperature of 11.4° C. As the temperature increases from 0° to 260° C. the resistance decreases from 150 to 20 ohms.—*Zeit. f. Angewandte Chemie.*

AUSTRIAN LONG DISTANCE TELEPHONE SERVICE.

At a prominent Austrian engineering society meeting, a paper on long distance telephony was read, reviewing the field and showing what Austria has done in that line of work.

The first interurban telephone line was the one between New York and Boston, 180 miles long, and opened for service in 1884. Two years later, in 1886, the Austrian government opened a similar line between Vienna and Brünn, having about the same distance. This line was not for telephoning alone, however, but equipped both for telegraphing and telephoning. Four years later a separate telephone line was opened for service between these two cities, and a short time after this service between Budapest and Vienna was begun. In 1896 telephone connection between Vienna and Berlin was established, and in 1900 the line Berlin-Paris, a distance of 720 miles, was considered the longest line in Europe. In the United States, the development was much more rapid, for in 1892, we had the line New York-Chicago, 912 miles long, to be followed in 1893 by the 1,100-mile line—Boston-Chicago. Since then these distances have been extended even further and at present telephone connection between New York and San Francisco, a distance of 3,000 miles, is contemplated. Europe has not been able to extend its lines to such enormous distances, but interurban telephone connection is more extended than that in the United States. Interurban communication is more developed in Europe, and especially Austria and Germany, than in America, where the greatest and most extensive service is within city limits.

On the technical side more attention has been paid to the development of the lines and current carrying agents than the actual transmitters and receivers used for intercommunication. The wires are of much more importance in the telephone service than they are in the telegraph service. Cables for example are better fitted for telegraph than telephone service, which fact enabled the laying of the submarine telegraph cables, connecting the continents, an impossible feat in telephony. Even the overhead lines had to be especially adapted to the telephone service, and the telephone engineers found the greatest problem in employing the earth as return circuit. A great step forward was the introduction of bronze and hard copper wires, which were first used in 1886.

Even greater difficulties were encountered in the electrical phenomena in connection with the telephone service. The damping effect especially gave much trouble, and it was only within the last ten years that anything certain was found out about that important problem. The damping effect increases in logarithmic proportions with the length of the line, so that the difficulties increase enormously with the increasing length of the line. With a value of the damping exponent of $Bl = 4$, only $1/27$ of the current reaches the end of the line, and if the line is increased by one-half the distance of the former length, the above exponent grows to $Bl = 6$, and the current sent into one end of the wire is decreased down to $1/201$ of the strength by the time it reaches the end of the line. The question was to decrease the specific damping effect B of the line, and this was done to some degree by decreasing the electrical resistance, in other words by using heavier wires. But here also the limits have been reached with the wires of 0.2 to 0.24-inch diameter, for the expense for heavier wires increase enormously as the distance of the line increases, as the following column shows.

Wire Used—	Efficient distance of line, miles	Expense for wires per mile
.08 in. bronze wire	180	$0.40
0.10 in. bronze wire	240	.65
0.12 in. bronze wire	300	.79
0.16 in. bronze wire	540	.138
0.20 in. bronze wire	720	.245

On the other hand the skin effect, *i. e.*, the effective resistance is increased considerably. The current lines are forced towards the outside of the wires, and the entire cross section of the wire does not carry the current as it ought to do. Another means toward the decrease of the specific damping effect of the lines is in the artificial increase of the self-induction of the lines. In overhead lines we can only consider the Pupin system of self-inductance, in which induction coils are placed on the lines at regular intervals. Especially the thinner wires give excellent results in this connection and the efficiency of the service has been considerably increased by using Prof. Pupin's method on European and American lines. No attempts have, however, been made to Pupinize the long distance lines of heavier wire, chiefly because success is not assured, since it depends on the height of the insulation resistance. If the latter decreases to 200,000 ohms, as was found by Devaux Charbonnel, the increase of the current strength is so small, when increasing the self-inductance, that the result does not pay for the increased expense. On the other hand, where we have an insulation resistance of one megohm, the increased self-inductance will result in increasing the efficiency by 25 per cent, the wire in this case being 0.2 inch cross section. The cost of the Pupinization would be very low, since the induction coils need only be placed on the line at distances of 12 to 18 miles. Increasing the insulation resistance to 2 megohms would increase the effect with Pupinization by about 58 per cent. Various trials have been made with telephone cables, but the results have not been as promising as might be desired. Even in cables, the insulation resistance for

alternating current is very low, the paper insulated cables being between 200,000 ohms and 2 megohms, the rubber insulated cables between 80,000 and 150,000 ohms. However, recent years have seen the use of several cables, both on land and on sea, and the success of the cable between England and France across the Channel seems to speak for the use of telephone cables for shorter distances. Within the last years or so the Swedish engineers, Egner and Holmström, have made extensive tests with long distance telephone apparatus and have perfected these and placed them in actual service on several long distance lines. So far the problem in this direction is still very far from being settled and it will be the aim of telephone engineers to establish standards for long distance telephone instruments just the same as those established for other lines of electric application.—*Elektrotechnik und Maschinenbau.*

Recent Telephone Patents

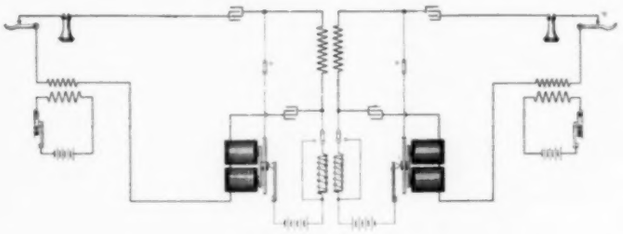
By David S. Hulfish

1,015,768. Telephone Repeater Circuit. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. The two telephone lines are jointed through an induction coil in the repeating station, and upon either side of the induction coil is a speech-current relay for increasing the energy of the speech transmission.

1,015,769. Telephone Repeater Circuit. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. The telephone line has but one voice-current relay, the receiving helix and the secondary of its induction coil being in series in one of the line conductors. The local circuit is closed by a pair of contact springs added to the switchboard jack.

1,015,770. Telephone Repeater Circuit. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. In this system, two lines are connected inductively at the repeating station, the strengthening of the speech currents in either direction being accomplished without any circuit-changing relays at the repeating station. The circuit is not balanced against side-tone or its consequent "singing."

1,016,036. Telephone Signaling System. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Chicago, Ill. The signaling circuit of this telephone line resembles composite circuits in some respects, and the selection and



1,015,768.

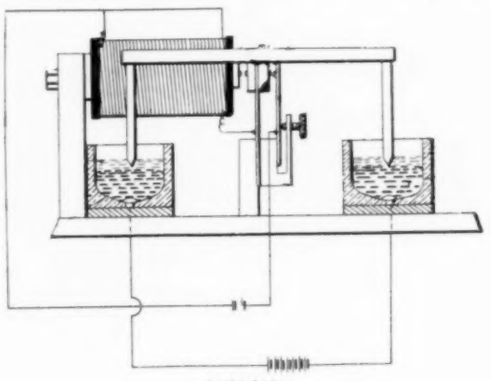
signaling of any station of the line is accomplished independently of the talking circuit of the line, and therefore may be done simultaneously with conversation.

1,016,063. Attachment. Louis Block, New York, N. Y., assignor to Leah Elizabeth Block, of same place. As a sanitary attachment for telephone mouthpieces, a ring for holding an antiseptic material is suspended by wire brackets a short distance in front of the mouthpiece funnel.

1,016,131. Line Disconnector. Cyrus G. Fields, Bucklin, Mo. People who are afraid of lightning coming in over telephone wires prefer to disconnect the telephone line during an electrical storm. The device of this patent brings into the telephone station two electrical conductors and a small rope. By pulling the rope a locking clamp on the line wire is released, dropping the line wire from the house entirely. The connection is made easily after the storm has passed, in readiness for disruption again when desired.

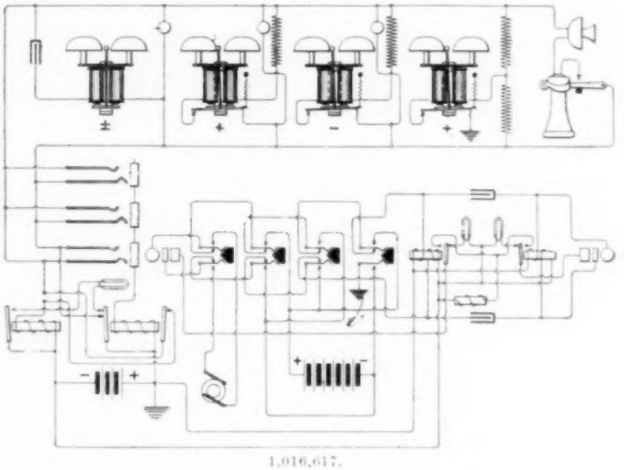
1,016,202. Composite System. Clinton L. Bopp, Hawkeye, Iowa, assignor of parts to Frederick Strate and John Moran, Waukon, Iowa. Filed March 23, 1907. A polarized relay is used in the telegraph circuit. Telephone ringing is done by current waves of a polarity not affecting the polarized relay, while telegraph transmission is done by currents of the reversed polarity. In this manner it is possible to ring over the composited telephone line in the manner usual with telephone lines not composited.

1,016,277. Lockout-Device for Party Line Telephones. Daniel W. Kneisly, Dayton, Ohio, assignor to the Dayton Telephone Lockout Manufacturing Company, Dayton, Ohio. Application filed Feb. 20, 1908. The device is a step-by-step device



1,016,546.

for each subscriber's telephone, all controlled from the central office switchboard, and it provides for the selective ringing of the call bell of the selected subscriber as well as for locking out all telephone instruments other than the one or ones selected.

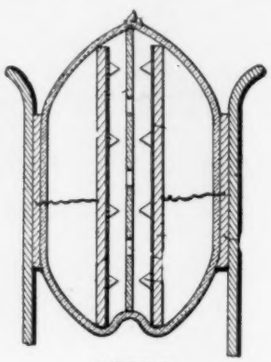


1,016,617.

1,016,546. Device for Generating Telephone Ringing Currents. William E. Butler, David City, Neb. A vibrating pole-changer arm is provided with mercury-cup contacts. Specialized mercury contacts and methods of making the mercury contacts are shown in the patent.

1,016,567. Spring-Armature Relay. William Kaisling, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. In a relay having a group of contact springs, the movable spring is made magnetic and acts as an armature and a contact spring at the same time.

1,016,617. Telephone System. William A. Fricke, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, Chicago, Ill. In a circuit of a four-party selective signal telephone line, one ringer is operated by alternating current from wire to wire, another by direct current from wire to wire, the



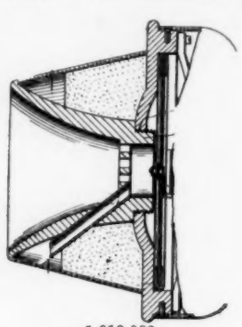
1,017,648.

third by reversing the direction of the direct current, and the fourth by direct current from both line wires to ground.

1,016,670. Listening Detector for Telephone Lines. Ernest Burgener, Wellesley, and Christian Burgener, Linwood, Ontario, Canada. Adjacent to the transmitter of the telephone is located an electromagnetic buzzer or other signal-sounding device, and an electromotor device actuating suitable means for making and breaking the circuit of the buzzer to cause the sounding of a predetermined signal. The device is operated when the receiver is removed from the hook, and again when the receiver is replaced upon the hook. Each telephone will have a different identifying signal, and the parties using the telephone line will hear and recognize these signals as any telephone is lifted or replaced upon the line.

1,016,847. Terminal Plate for Telephone Desk Stands. Gustav Nelson, New York, N. Y. A patent for a specific manner of mounting and arranging the hook switch springs for a telephone desk stand, arranging them upon a plate in the standard of the stand, with a block insulating material so placed as to obviate the bushing of numerous screws.

1,017,036. Wiring Tack. Charles C. Blake, Brookline, Mass. A wiring tack comprising a metal plate having its ends bent over and downward with a central opening through the metal, a nail or pin having its head supported in the opening, and an insulating lining covering the interior surface of the metal plate, the central portion of the insulating lining being doubled



1,018,082.

and extending downward, forming a midway partition and protecting the nail or pin from contact with the wires held. Designed for tacking up paired or duplex wires by driving the tack between the wires, the insulation-lined metal plate holding the wires securely in place.

1,017,085. Telephone System. Fred M. Davis, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place. A local-battery telephone line has an answering jack adapted for a local battery cord circuit and multiple jacks adapted for common battery cord circuits, means being provided to prevent current from flowing over the line when the line is connected with by a common battery cord circuit.

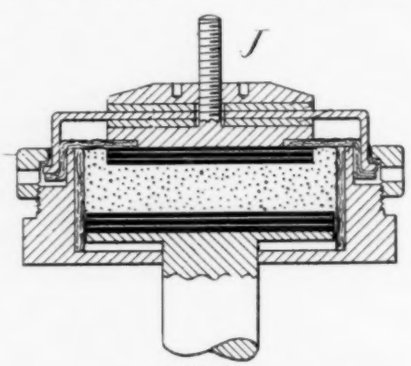
1,017,362. Attachment. Charles Adams, New York, N. Y. A sanitary attachment for a telephone transmitter, comprising a paper cup of suitable size and shape to pass entirely over the funnel and transmitter casing, clamping the edge of the transmitter casing and thereby holding itself in place.

1,017,616. Telephone Repeating Circuits. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. In a repeating station, a relay operated over the line charges a circuit-changing relay to close the local circuit of the repeater, under control of the hook switch of one of the connected telephones.

1,017,617. Telephone Repeating Circuits. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. A voice-current relay in a telephone line has its receiving helix in one side of the talking line pair and its induction-coil secondary in the other side of the talking line pair.

1,017,648. Vacuum Lightning Arrestor. Frank S. Chapman and John T. Greene, Toledo, Ohio, assignors to the National Electric Specialty Company, of same place. The object is to provide an arrestor which will furnish a good path for a static discharge, but will not maintain an arc. A sealed vacuum capsule contains electrode plates with discharge points, the electrode plates being connected with contact plates outside the capsule for completing paths to the conductors to be protected.

1,017,680. Attachment. M. M. Marcuse, Far Rockaway, N. Y., assignor to West Disinfecting Company, New York, N. Y. An attachment for holding a disinfecting pad across the front opening of a transmitter funnel, comprising two metal sheets over the mouthpiece, with space for disinfectant between them, the sheets being separable to renew the disinfectant as desired.



1,018,182.

1,017,967. Selecting Device. Frank E. Granger, Aberdeen, S. D. A station selecting device for telephone party lines. The step-by-step principle is used, and at each station a call sender is provided also. The call sender will send any desired impulses. The selecting device has a clock train which is released when the stepping device reaches the proper position to ring that station, and the station will be rung if the stepping device stops there, but will not be rung if the stepping device proceeds farther while the clock train device is running down.

1,018,082. Attachment. Charles R. Rogers, Waverly, N. Y. An antiseptic attachment for telephone transmitter mouthpieces, comprising a box-like casing around the mouthpiece funnel and a opening or tubular passage from the casing, containing antiseptic, into the air chamber in front of the transmitter diaphragm.

1,018,182. Telephone Transmitter. Felix Gottschalk, New York, N. Y. In the improved carbon cup, the thin flexible diaphragm of the cup, usually made of thin mica, is avoided by providing a heavy rigid cap and so constructing the edges that the cap may slide with the movements of the movable electrode. An improved form of case also is shown.

1,018,226. Telephone Repeating Circuits. Charles Adams-Randall, New York, N. Y., assignor to Randall Telephone Manufacturing Company, Augusta, Maine. In the preliminary description of this patent, the inventor states that his object is to provide means whereby the speech received upon one main line circuit may be repeated upon two or more other circuits.

1,018,375. Selective Signaling System. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Sandwich, Ill. The stations in this system have each a stepping device, but the stations are arranged in two groups, and the devices of one group are operated without disturbing the other devices of the other stations of the line.

DEPARTMENT of RAILWAY TELEPHONES

The Pennsylvania's Eastern Circuit Boss

J. C. Johnson, Supt. of Telegraph

RAILROADS are like electric circuits. They have lines and switches and bridges and shunts and terminals. For a closed circuit, metallic return, you have to buy a round-trip ticket. If you get on without a ticket you are short circuited to ground, often with the development of considerable heat.

Railroads have terminals at both ends, where they should be; but some of them have also a terminal in the middle. Pittsburgh and Buffalo are good examples of this practice of putting a third end near the center. That is why you hear of the Pennsylvania lines east of Pittsburgh, or west of Pittsburgh, as the case may be.

J. C. Johnson, Superintendent of Telegraph.

If you examine a regular map of Pennsylvania—that is, not a railroad map—your first impression will be that the draftsman got confused between the railroads and the rivers, and transposed most of them. As a rule the rivers are the straightest. In the Keystone State there are so many wrinkles on the face of Mother Earth that when a railroad gets a train into some of the towns, it has to turn around three times, and back up a couple of miles to get out again. In places a passenger has been known to drop an orange off the observation platform and hit the fireman in the eye.

So it is a rather difficult matter, for one unfamiliar with local geography, to trace a line of railroad across the state, especially since the map of Pennsylvania is planted thickly with towns and mountains in small type. But close inspection reveals the fact that the Pennsylvania Lines, east of Pittsburgh, pass directly through the geographical center of the state. This particular spot is marked by the flag-station Curtin—a village of unrecorded population but of mathematical location. Curtin is in the center of Center county, in the center of the state.

It was at this romantic spot that J. C. Johnson was born in the first year of peace after the civil war—to be exact, on April 26, 1866, which makes this day of writing his 46th birthday. Passing rapidly over the pleasant years of country boyhood, we hasten to record his entrance into the service of the Pennsylvania Railroad Company, January 5, 1885, as a telegraph operator on the Schuylkill division. At the end of a brief thirty months of operating (June 1, 1887), he was made train dispatcher of the division. And 5½ years later (January 1, 1903), he became assistant train master on the Schuylkill division.

That brings his record up to the last nine years. During that time Mr. Johnson has been division operator and assistant train master of the Schuylkill division (November 16, 1905), chief clerk to the superintendent of telegraph at Philadelphia (October 24, 1907), and became superintendent of tele-

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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graph for the Pennsylvania Lines east of Pittsburgh, January 15, 1910, which is merely another example of what ambition and opportunity can do by a little team work in the railroad game.

J. C. Johnson is an active member of the Association of Railway Telegraph Superintendents. He attended the last annual meeting at Boston, in June, 1911, with his wife and daughter, and served on the entertainment committee. His contributions to the discussion which took place at that time on the subjects of insulation, transposition, etc., were very interesting. Mr. Johnson lives at Narberth, Pa., a suburb north of Philadelphia.

Ohio Commission News

It was reported April 5 that after years of effort on the part of the independent telephone companies to gain entrance for their toll lines into Cincinnati the fight was formally carried before the Public Service Commission of Ohio today for the purpose of requesting that body to order physical connection between the exchanges of the two companies at Hamilton.

The Cincinnati and Suburban Bell Telephone Company and the independents of Hamilton were represented before the commission, the latter claiming to represent also a great number of complainants and the Hamilton Chamber of Commerce.

It will be some time before the commissin is prepared to pass upon the question, and when it does so, whichever way the decision may be, it is conceded here that appeal will be taken, leaving the case really undecided until it has passed through the Common Pleas, the Circuit and finally the Supreme Court of Ohio.

The chief contention today hinged upon the wording of a clause in the public utility act passed by the last General Assembly. That clause set down the principle that the commisison may enforce physical connection between two telephone exchanges in order to reach points "not reached by either exchange."

The Cincinnati and Suburban Bell Company sought to show by testimony that a connection between the two exchanges would be destructive to their business.

The independent people claim in their proceedings that they have between 3,500 and 4,000 subscribers in Hamilton who are deprived of their connection with Cincinnati because the Bell people have made it impossible for the independents to build their lines to that city and will not permit them to connect over the existing lines of the Bell.

Questioning by both sides and by members of the Public Service Commission brought out the fact that one side claims the Bell neglects its local service, and will not put in telephones for local subscribers unless there is a sufficient number on that line to make it particularly profitable. On the other hand the Bell people claim they extend their lines whenever requested, and that all who apply to them for telephones get them.

The Sidney Telephone Company, Sidney, has filed a complaint with the Ohio commisison to the effect that the Farmers' Telephone Company of the same place has been issuing stocks and bonds since July 1, 1911, without the consent of the commission. The complaint further alleges that the Farmers' company has been soliciting subscriptions to its stock in the village of Anna, representing that it has franchises from the village and that rates have been cut in Sidney, with discrimination in favor of the stockholders. The petition asks that no authority to make extensions be granted the Farmers' Telephone Company until an investigation is made.

Courtesy on Railroad Telephones

Officials of the Chicago & Northwestern road are conducting a campaign of telephone courtesy. Employes are being urged to observe that promptness, politeness, and a soft, pleasant vocal expression over the telephone are needed.

In connection with the "courtesy campaign," the company announces it will insist upon the use of the same degree of politeness in telephone conversations as is expected when addressing patrons face to face. According to the announcement, the fullest co-operation of all employes is asked in an endeavor to remove the telephone from the domain of irritation, rude, and inefficiency, and to place it entirely within the province of politeness, satisfaction and efficiency.

The new rules are as follows:

Answer all telephone calls promptly; it is not good manners to keep a caller waiting.

Be particularly careful of the tone of voice in which you speak over the telephone.

In answering a call for the company over any of the company's telephones, make it a point to see that the person speaking gets the information he wishes with the least possible inconvenience to himself.

Always avoid asking directly the name of the person calling. A little diplomacy may save the caller irritation and you the charge of being rude.

A copy of the above rules has been supplied all the employes of the road.

G. R. & I. to Use Telephones

According to reports current in railroad circles, the day is not far distant when the Grand Rapids & Indiana Railroad will abolish telegraph train dispatching service on its Missaukee and Traverse City branches.

The success of the telephone system of train dispatching that has been attained by the Pere Marquette Railroad has been closely studied by the G. R. & I. officials and has been found satisfactory.

As a result, it is rumored that this year will see telegraph train dispatching done away with on the Lake City branch and the telephone system installed. At the present telephone dispatching is used between Kingsley and Walton Junction, Bond Mill and Manton, and M. O. Siding and North Yards.

This service is satisfactory and it would need but a small outlay of equipment to complete the circuit through from Traverse City to Cadillac. This portion of the work may not be done this year, however. The change on the Missaukee county branch is said to be slated for the improvements this year.

The American Protective Tariff League, 339 Broadway, New York, will furnish gratuitously information and facts on any phase of the tariff question on postal card request.

Use of Telephones in Railway Service

By G. K. Heyer *

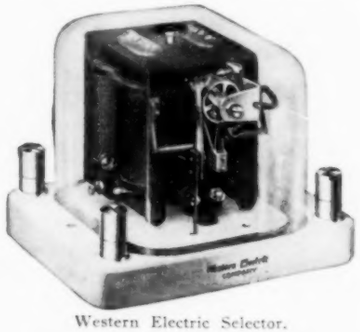
FOR the past four years a great deal of attention has been given by the progressive railroads to the improved method of handling train movements known as telephone train dispatching. There are, at the present time, approximately 285,000 miles of railroads in the United States and Canada, and the 55,000 miles of road which has been equipped for this new method of handling traffic stands as a monument to the success of the undertaking.

It is thought that a brief outline of the history of train dispatching would be interesting before going further into the subject.

Previous to the time of the introduction of the telegraph, trains were run on what was called the "time interval" system. With this system the ruling train had the right of one hour against an opposing train of the same class. Under this method of operation a great deal of time was lost if trains were late, and it was through the foresight of Superintendent Charles Minot, of the Erie Railroad, that the telegraph, in 1850, made possible the abolition of the old "time interval" and "flag" system of advancing trains and the adoption of the telegraph dispatching system, which it was thought, for many years, possessed sufficient advantages to allow other branches of railroads to be developed to the greatest possible efficiency.

In recognition of the marked advance made by the use of the telegraph in 1850, the National Association of Railway Superintendents of Telegraph is having erected at Turners, New York, a monument to the memory of Charles Minot, who gave the first telegraphic train order from that point. It is expected that this monument will be completed and unveiled in May of this year.

After the telegraph was first used by the Erie, there was begun, in 1851, a systematic attempt to



Western Electric Selector.

telegraph orders from a central point to trainmen and conductors, and from that time up to the latter part of 1907 all train movements were directed by the telegraph.

While October, 1907, marks the first successful installation of telephone and selector equipment for train dispatching, there were previous to that time a number of roads which used the telephone equipment for handling train movements. As early as 1883 the New Orleans and Northeastern Railroad used the telephone for this purpose. The service was rendered over a grounded iron wire about 100 miles long, with the ordinary magneto telephone, as used at that time, and without the aid of the selector, which mechanism has made possible selective calling on long heavily loaded railway telephone lines.

The telephone equipment used on all of these installations was far inferior to that in service at the

Dispatcher, Harrisburg, Pa., Penna. R. R.

present time, and the great improvements which have been made in the last two or three years in the telephone and selective apparatus, together with the new apparatus designed to meet the special requirements of the service, indicate that there are few, if any, requirements for communication to meet the conditions of the railway service which cannot be met by the use of the telephone.

The New York Central was the first to install and actually operate trains by means of the telephone and selector equipment. Their first installation was completed in October, 1907, on a section of the main line between Albany and Fonda, with 16 way stations. The installation on the New York Central was closely followed by a number of installations on the Chicago, Burlington & Quincy, where in December, 1907, the main line between Aurora and Mendota, Illinois—a distance of 46 miles, with 11 stations—was equipped. After this, a section from Aurora to Galesburg, Illinois—a distance of 125 miles, with 16 stations—and another between Aurora and Clyde (the end of the Chicago Terminal, a distance of 28 miles. These circuits all covered double track where reverse movements were made.

Within a short time after the completion of these circuits, and convinced from the results obtained that single track operations presented no problem which could not be solved by the use of the telephone, the Burlington equipped a single track section between Aurora and Savannah, Illinois—a distance of 106 miles, with 23 way-stations.

These installations on the New York Central and Chicago, Burlington & Quincy produced the proof for which many had been waiting, and these roads can justly be called the pioneers in telephone train dispatching. The proof was so conclusive and the re-

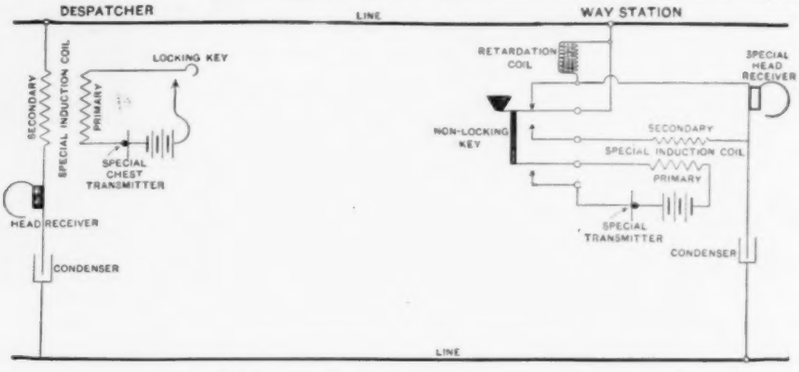
*Paper read before the Railway Club of Pittsburgh.

sults obtained so satisfying that the subject became at once one of world-wide interest. This interest, however, until very recently, did not take the form of installations on railroad systems, except on railroad systems of the United States and Canada, and there are in these countries about twenty railroads which have over 1,000 miles of road equipped with telephones and selectors, the aggregate mileage for these twenty roads being approximately 40,000.

In spite of the success attending the early installations on the New York Central and the Chicago, Burlington & Quincy Railroad, there were many things to be overcome before the adoption of the telephone and selector system could be made general. It is a well-known fact that a great many of the officials of railroads in this country have come up through the operating departments, and as these men had expressed themselves by means of the Morse key, they had come to consider the telegraph as much a part of the regular operation of the system as to believe it synonomous with quick, safe and efficient operation.

They were disposed to let well enough alone and could not feel themselves free to advocate the use of

Selector Set (Open).



High Efficiency Train Dispatching Telephone Circuit.

a system which, to them, was comparatively new and untried. The attitude of the operators themselves also had a somewhat deterring effect on the adoption of the new system. There was a feeling among the dispatchers and operators that the passing of the telegraph would seriously affect their positions. Thus far, however, this has not been borne out, and the railroads have shown every disposition to retain the operators in their old positions. On serious thought this could only be expected, as the welfare of the railroad makes necessary the employment of men who know the railroad business, and in few cases, if any, have operators lost their positions due to the adoption of the telephone, except as a result of some act of their own.

There were many who believed that the telephone would be satisfactory on double and multi-track operation, but there was much skepticism with regard to its use on single track roads. When carefully considered, however, it is believed that any means which would allow the dispatcher more clearly to express himself and thus relieve the traffic problem on double-track roads, would lend themselves with added benefits to the solving of more complex operations on single-track systems. This has been borne out by subsequent events and the single-track divisions are the ones in which the advantages of the telephone system are most apparent.

The early prejudices of the dispatchers and operators have been entirely overcome, particularly on divisions where the telephone system has been installed and not one out of the great number of dispatchers with whom I have talked would care to go back to the telegraph method of handling train movements. There are many dispatchers who, through the continual operation of the telegraph key, have developed operator's paralysis in a greater or lesser degree, and these men cannot speak too highly in praise of this system which, as some of them have expressed it, have given them a new lease on life.

The following, taken from an article written by Mr. C. H. Gaunt, formerly Superintendent of Telegraph of the Santa Fe, and printed in the Santa Fe Employees' Magazine, expresses very clearly what has been experienced by many dispatchers:

> The telegraph is used by the train dispatcher in the intricate operation of his trains for one purpose only—that of communicating with the operators scattered along a stretch of railroad.
>
> Long use has developed a certainty of action in telegraph manipulation which commands the respect of all, but how often has a half-frantic dispatcher wished he could use his voice to the men with whom he must communicate, and thus avail himself of the rapidity of action, the definiteness and the security that would follow.

When it was first thought of utilizing the telephone for the important service of handling train movements, it was at once apparent, in order to make it a success, that some selective device must be developed whereby any particular station, or a number of stations on a long, heavily-loaded line could be called quickly and reliably without interfering with the other stations on the line. Thus, in order for the telephone to be used in place of the telegraph for this class of work, it was necessary to develop a system that would meet the following requirements:

1. Reliable means of selectively signaling one or more stations on a long and heavily-loaded line other than by code ringing.

2. Arrangements permitting the signaling to be done in such a manner as not to interfere with conversation being carried on over the line at the same time.

3. Some indication or answer-back by the dispatcher that the signal bell at the station called was operated.

In the attempt to develop a system to meet the

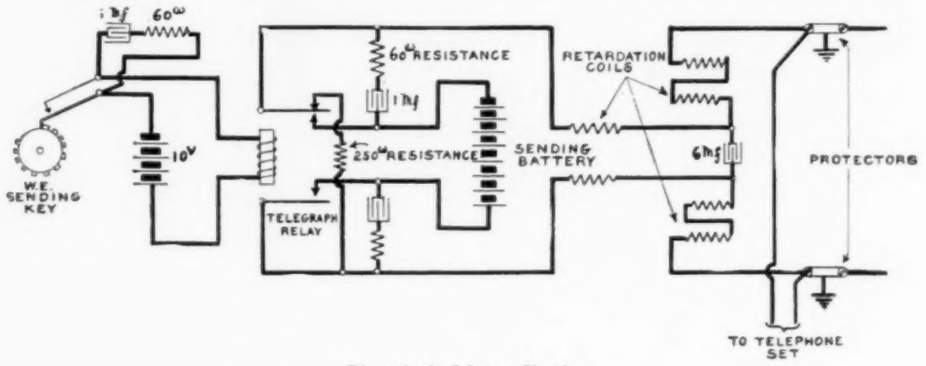
above requirements, three selector systems were developed:

1. The series relay selector.
2. The bridged relay selector.
3. The bridged selector system.

The series circuit was fairly satisfactory, but there were a great many disadvantages. In this system the selectors operated from the contacts of a relay, the windings of which were in series with the line, the relays at alternate stations being placed on alternate sides of the line. The principal disadvantages of this system were that it increased materially the resistance and impedance of the circuit, thereby somewhat impairing telephonic transmission; the troubles experienced from inductive effects were more noticeable, due to the unbalanced condition of the line and burn-outs from lightning were much more frequent.

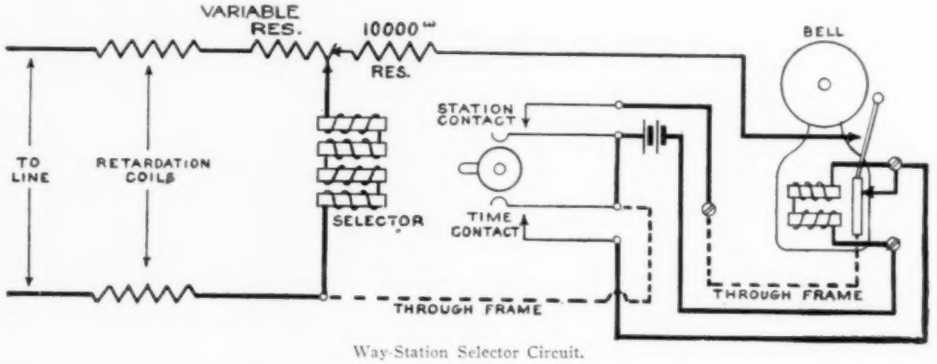
The bridged relay system was a modification of the series relay system in that the relays were wound to a high resistance and were placed across the line instead of being in series. This was somewhat of an improvement over the series system, but was soon replaced by the bridged selector system, in which the selector windings were connected directly across the line, doing away with the necessity of using a relay and these systems are all of the general bridged selector type.

When the selector was first applied to railroad telephone lines as a means of calling, in place of the old code ringing system, the standard local battery telephone sets were used. It was found, however, that the conditions to be met on lines of this character were so severe as to require a special transmission circuit. In the old form of circuit, the receiving circuit was composed of the secondary of the induction coil, the receiver, and the condenser connected in series bridged directly across the line. The total impedance of this part of the circuit to talking current was approximately 600 ohms, about 300 ohms of which was in the receiver and, therefore, active for receiving purposes.



Dispatcher's Selector Circuit.

It is obvious that when a number of other sets are bridged across the line at the same time, the combined impedance of the bridges in parallel is very low and the transmission correspondingly difficult between the terminals or widely separated stations. To overcome this trouble it was necessary to design a circuit in which the receiving bridge had a much higher impedance and at the same time arrange the circuit so that this impedance was not inactive, thereby resulting in a considerable loss in transmission.



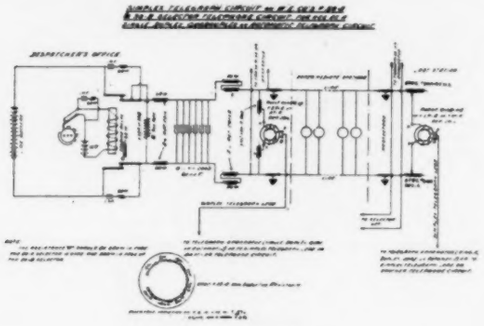
Way-Station Selector Circuit.

and thereby reducing the equipment in the selector sets to a minimum and providing a system with only one contact, the function of which was to close the bell circuit. These selectors were wound to a high resistance and the impedance to talking current was such that little or no appreciable loss in transmission was experienced. There are, at the present time, several selectors which accomplish the desired results

The circuit known as the Western Electric standard high efficiency telephone train dispatching circuit was designed by the engineers of that company to meet the severe requirements encountered. A switching device was provided in the circuit to be operated when talking. In the normal position, with the receiver removed from the hook, the receiving circuit connects merely by a condenser and a special

receiver bridged directly across the line. The impedance of this circuit is about 2400 ohms to talking current, practically all of which is in the receiver, which is wound to approximately 610 ohms. Normally, neither the primary nor the secondary circuits are closed through the induction coil.

The circuit was arranged in this manner so as to reduce the drain on the batteries when receiving and to obviate the necessity of receiving through the



Simplex Circuit.

secondary winding of the induction coil, as this would cause a considerable loss in the incoming transmission.

When the switching mechanism is in the operated position the circuit is arranged for talking, as the operation of this switch closes both the primary and secondary circuits through the induction coil and, at the same time cuts in series with the receiver a retardation coil, the receiver and retardation coil being in parallel with the secondary winding of the induction coil.

The combined impedance of the receiver and retardation coil is high enough so that the outgoing transmission is not noticeably affected, and low enough to allow the dispatcher to break the operator. This circuit is in operation on lines up to 300 miles in length, with as many as 45 stations, 20 of which may be listening simultaneously without seriously affecting the transmission.

In order to utilize to the fullest extent circuits which have been installed for telephone train dispatching purposes, these lines are being simplexed and phantomed to provide additional telegraph and telephone facilities, without increasing the expense for line construction. The ordinary method of simplexing is to bridge the repeating coil at each end of the line and tap out at the middle points for connection to the telegraph circuit.

This method of simplexing lines on which selectors are operated increases the direct current drain on the signaling battery, and to keep this battery drain within reasonable limits non-inductive resistances are placed between each side of the simplex coil and the line.

Another method of simplexing, which was designed by U. J. Fry, Superintendent of telegraph of the Chicago, Milwaukee & St. Paul, does away with the simplex coil at the end of the line nearest the dispatcher, and thereby decreases the current drain on the selector sending battery. Circuits showing these two methods of simplexing will be shown and described in detail later.

Another means of increasing the efficency of the wire plant where dispatching and message circuits are strung over the same divisions is by making use of the phantom circuit, which consists of applying retardation coils and condensers to the existing message and train circuits in such a way as to secure an additional telephone line without additional line construction; that is, by the use of the phantom circuit in connection with the train and message wires, telephone conversations can be carried on simultaneously over the two pairs of wires. A number of such installations have been made and are proving very satisfactory.

Another feature which is of vital importance in train dispatching is the manner in which the lines are constructed and maintained. First of all, in installing telephone train dispatching equipment, it is absolutely essential, if satisfactory results are to be obtained, to have a metallic circuit and use wire such as will provide ample transmission. The wire adopted as standard by most of the railroads for train and message service is No. 9 B. & S. hard-drawn copper, weighing 208 pounds to the mile. Of course, on short lines and branches, iron wire may be utilized and the following figures illustrate the differences which will be obtained in transmission with different sizes of copper and iron wire:

The standard for commercial transmission is rated in terms of No. 19 gauge cable, and the transmission over 30 miles of this cable has been adopted as the limit of standard commercial transmission. The transmission over 900 miles of No. 8 B. W. G. copper, weighing 435 pounds to the mile, is approximately equivalent to that obtained over 30 miles of No. 19 gauge cable. With No. 9 B. & S. copper, 208 pounds to the mile, 500 miles is the limit, and the limit with

Way-Station, Michigan Central R. R.

No. 8 B. W. G. iron is reached at 144 miles. This does not mean that intelligible transmission cannot be obtained over greater lengths of line than given above, but that these figures represent what has been adopted by the A. T. & T. Company as standard commercial transmission.

A comparatively new wire, known as copper-clad wire, which has been largely used by the signal departments of the railroads, should prove very satisfactory for branches and lines up to 200 miles in length.

This wire is constructed of copper and steel in such a way that the steel core is entirely covered by copper so welded to the steel that the wire can be drawn very successfully in the smaller sizes. Copper-clad wire for the shorter circuits has the advantage of increased conductivity as compared with the steel or iron wire and an increased tensil strength as compared with copper. The increased tensile strength of No. 9 B. & S. copper-clad wire, as compared with No. 9 B. & S. hard-drawn copper, is approximately 45 per cent, and the conductivity of the copper-clad wire ranges from 30 per cent to 50 per cent that of the same size hard-drawn copper, depending on the grade specified.

In stringing wires, a careful investigation should be made to find out just what class of service the other wires on the pole are being used for, so that the proper transpositions can be made to avoid trouble from inductive disturbances. It has been found, in the majority of cases, that if the wires are transposed every half mile, little or no trouble will be experienced from this source. In other cases, however, it has been found necessary to cut in additional transpositions on some sections of the line where the exposure is very severe. If the pole lines carry wires which are used for Barclay printing circuits or for quadruplex telegraph service, telephone wires should be placed as far as possible from these. Care should be taken on planning the transposition scheme to have both wires of the pair throughout their entire length subject to exactly the same exposure. This will in all ordinary cases neutralize the inductive effects from foreign circuits.

If the ultimate plan is to use the telephone for handling both train and message business, it is advisable to transpose the wires so that phantom circuits can be obtained without the necessity of making further transpositions at the time the phantom equipment is applied to the lines.

A comparison of the telephone and telegraph systems in operation will show the many advantages of the former. With the telephone, the orders are issued verbally by the dispatcher word for word, in place of being sent out by code, and the speed which may be attained is limited only by the ability of the operator to copy the messages. The forms used are the same as with the telegraph, and the operators repeat the orders back to the dispatcher for his O. K.

It is a well-known fact that the rate of sending attained by the average railroad telegraph operator is about 25 words a minute, while with the telephone a speed of 100 words or more may be attained.

Experience has shown that 14 to 16 train orders may be put out in one hour with the telephone, while with the telegraph a dispatcher was doing exceedingly well to send out half this number.

The greater speed possible with the telephone is also shown in the reporting of trains, that is, the stating of time of the passing, arrival or departure of trains at stations. The dispatcher is, of course, always in on the line, and, as is customary, the station operator, when wishing to report, merely removes the receiver from the hook, and, after being assured that the line is not busy, calls his station name. The dispatcher instantly replies by saying "dispatcher;" the report is then given, usually in the fractional part of the minute. Information regarding accidents, derailments, etc., are conveyed to the dispatcher verbally by either the operator or the conductor, and the narration is at once so complete that the chances of misunderstanding and the necessity of additional messages are eliminated.

The use of the portable telephone puts the conductor in immediate touch with the dispatcher in case of a breakdown or other trouble between stations, while with the telegraph it is necessary to reach the nearest telegraph office to send in call for help. One of the large roads in the East has over 500 of these portable sets in use, having equipped a large number of the passenger and freight trains and all of the wreck trains with them. Further, the use of siding sets is of great value in that they enable the train crews to reach the dispatcher and keep him advised of their movements.

In some cases the roads have installed semaphore signals at sidings to operate in connection with the selector to enable the dispatcher to set the semaphore against any train desired and have the conductor report by telephone for orders.

In calling, the selector makes possible the operation of a bell at any station desired by the mere act of turning a button located within easy reach of the dispatcher and corresponding to the station wanted. This answer-back is caused by the making and breaking of the bell contacts across connected in series with the bell and thus producing an inductive effect, which is repeated in the dispatcher's receiver. The fact that the dispatcher has a means of knowing that the bell has operated, coupled with the better signal produced by the ringing of an electric bell, as compared to the click of the telegraph key or sounder, arouses an immediate response, and the time of calling offices is practically eliminated. Further, if occasion demands, the advantage of calling stations in on the line while a conversation is being carried on may be resorted to. In fact, this feature is used continually on divisions where the traffic is heavy and the rate of calling is high. If for any reason the first call failed to raise the operator, a second call may be sent out and the bell kept operating at the will of the dispatcher until a response is received.

With regard to the accuracy of the telephone as compared with the telegraph, it may be stated that since the telephone has been used for the directing of train movements, not only since 1907 but also previous to that date, when the equipment had not reached the present state of perfection, not a single accident has been reported resulting from the use of the telephone. Greater accuracy of transmitting orders is assured, as the dispatcher writes down the words as they are thus spoken, thus completing his record as the order is given and checking this record, word for word, as the order is repeated back by the operator.

With the telegraph the dispatcher sends his order and the record is made by his copying it as received from the operator. It will be readily seen that with this method the chances of error are greater on account of the liability of the dispatcher not catching errors in the repeat, due to the inclination to write down the messages as sent out by him.

The ease and speed with which the dispatcher can handle his work is believed by many railroad men to be a further guard against accidents. The increased

speed of calling and transmitting allows more time for laying out the work, planning of meeting points, etc., thus relieving the dispatcher of much of the mental and physical strain of trying to keep traffic moving and the almost continual operation of the telegraph key.

It is claimed by some that the translating of the sounds received over the Morse wire is done automatically. This may be true to a certain extent, but nevertheless this translation requires mental effort and this mental effort should be available for other purposes. Then the physical strain, which sometimes results in operators' paralysis, has a damaging effect under the severe conditions frequently experienced, due to congestion of traffic resulting from wrecks or hold-ups of any other kind.

With the telephone the dispatcher is in closer personal touch with the men along the line than with the telegraph. This is shown by the fact that a number of sharp remarks made over the telephone have greatly decreased or that such occurrences have stopped altogether since the installation of the telephone.

The likelihood of misunderstandings is remote, and this feature can be readily understood by those not familiar with railroad work, if one will consider how much more satisfactory any conversation may be carried on by telephone with a person located at a distant point than is possible by the telegraph or the mails.

Due to the federal and state laws limiting the working days of the railroad employees occupied in the receiving and transmitting of orders pertaining to train movements to eight hours, a considerable increase in the number of men necessary for handling the work was effected. Before the passage of these laws the field from which the railroad companies could draw operators was none too large, and the burden of securing the necessary help was greatly reduced by the introduction of the telephone, in that when occasion demanded, men could be taken from the other departments, as the requirements no longer necessitated the ability to send Morse. A field at once opened to trainmen and other employes who had met with such accidents as to incapacitate them for the class of work previously performed.

Under the severe conditions experienced along the Pacific Coast, where the heavy salt fogs make the operation of the telegraph almost impossible, the telephone has been operated satisfactorily on the lines of both the Santa Fe and the Southern Pacific.

In summing up, the advantages which must be conceded to the telephone method of operations are that it is quicker, safer and more reliable, and in addition makes possible better discipline and co-operation between the dispatcher and operator, as well as providing means for officials who are not familiar with the Morse code to exercise supervision and obtain immediate and accurate information in cases of emergency.

With the great increase in the number of telephones for commercial service and the consequent economies effected, it is only to be expected that the use of the telephone for railway service will gradually be extended to embrace many other branches. In fact, it has already been done on some of the more progressive roads.

For handling message or other commercial and routine business between stations, the worth of the telephone has already been proven on several roads, and it is estimated that for this class of business one telephone circuit has the capacity of two telegraph circuits. On roads where the traffic is light, both the dispatching and message work can be carried on over the same pair of wires.

In connection with manual blocking, the old telegraph wires may be utilized, thus providing a grounded block circuit, or, if convenient, a metallic circuit may be employed. Either the grounded or metallic circuit is far superior to the telegraph. Blocking sets or a switching mechanism may be provided to allow one set of telephone equipment to be used on the train, message and block wires, and to cut two blocks into one for night operation.

The loud-speaking receiver is admirably adapted for this service and, it is thought, will ultimately replace the ordinary receiver for block work.

Another use for the loud-speaking receiver is in the dispatcher's office, where it may be connected directly to the train wire and relieve the dispatcher of wearing the head receiver at least part of the time.

This instrument, in connection with a special transmitter, may also be used in terminals for announcing trains.

The yardmaster, in the discharge of his duties, will find the yard circuit of the greatest value in keeping in touch with the various departments over which he has supervision.

For moving trains out of terminals the telephone has, in cases where installed, proven so much quicker and more flexible that there is but little doubt that all terminal circuits will within a short time be telephone circuits.

The train order semaphore, one of the recent developments, which consists of a standard semaphore mast arranged for mounting the selector and telephone apparatus in a weatherproof compartment, can be placed at any point along the line and the telephone and selector connected directly to the train wire.

In the large freight sheds and at transfer points, in office buildings, etc., and in fact at all places where direct communication between parties not located in the same room is desired, the telephone will prove in.

Cincinnati Boosters Get Traveling Service

The Cincinnati Commercial Association was provided by the Cumberland Telephone and Telegraph Company, operating in Eastern Kentucky and Tennessee, with connections to the "Boosters' Special" by long distance with Cincinnati every night during the five days' tour of the trade expansion excursion. These connections were arranged for at Lexington, Ky., Harriman and Chattanooga, Tenn., and Middlesboro, Ky., the telephone being placed in working order as soon as the train was berthed for the night.

The telephone booths on board the train were located in the observation car and the service was open to all members of the party. In making the arrangement with the telephone company, it was stated specifically that the first news to be sent in from Cincinnati every night should be the score of the game played by the Reds, a special bulletin board being rigged up in the commissary car to carry the score from day to day.

Of Interest to the Trade

By A. L. Haase

Pension Plans for Employees

The plans of the Western Union Telegraph Company for an employees' pension system, announced by President Vail of that corporation, has developed a new phase of one of the most interesting industrial questions of the day. It is not merely one of more and more railroad companies, big corporations, and smaller industrial plants adopting, as they are, such systems to provide for the old age or invalidism of valued employes. Nor is the question wholly one of the workingman's greater efficiency and faithfulness when he is assured that he and his family will be provided for in case of his death, illness, or loss of earning power with advancing years.

The real question behind President Vail's announcement embodies both of these elements. But it is much bigger and deeper than either. It is the story of an evolution from simple and costly beginnings to a series of pension systems in Europe and America as nicely adjusted to the risks as are the tables of a mutual insurance company, and presaging, in the different angles of its development, the ultimate, practical industrial pension with solvency assured, at a minimum cost to both employer and employe.

"It is by firm belief," said President Vail, while announcing the pension system of the Western Union Company, "that all employes, identified by years of faithful service, are entitled to some financial protection against the necessity of retirement, and it is the hope of the company that this beginning will extend to a further protection of employes. Meanwhile, the inauguration of the pension plant marks an expression of appreciation on the part of the company of the loyal and efficient service rendered by its employes.

These words go to the very heart of the question. For they suggest the problem that confronts the wage worker in the uncertainties of the future, especially of his old age, as well as the benefits realized by the employer in having employees who will stand by him and win pensions.

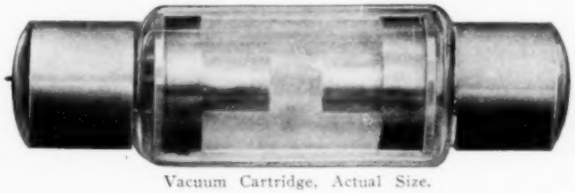
The last examples of such pension systems are found in Europe. They have been elaborated there to a greater degree than in America. They apply to wage-workers of every class, are the result of years of experiment and, in many instances, are under government patronage.

The system of the Western Union provides for the payment of one per cent of the average salary for the ten years preceding retirement multiplied by the number of years of service, after twenty and up to twenty-five years of employment. For men who have been with the company longer than twenty-five years this basic percentage is increased. After twenty-five years and up to and including the thirty-fifth year one and a half per cent additional is granted for each additional year. After thirty-five years and up to and including the fortieth year of service, the pension will be two per cent additional for each additional year. After forty years of service the ratio will be fifty per cent. The plan was perfected by a committee comprising A. R. Brewer, treasurer; William Holmes, superintendent of the tariff bureau, and F. B. Bliss, a special agent of the Western Union Company. For the present, the corporation will provide all of the funds for the pensions.

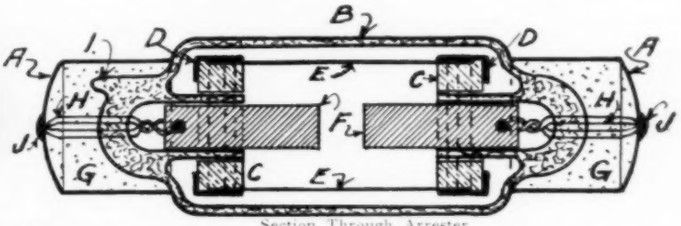
Brach Vacuum Arresters

The L. S. Brach Supply Company is introducing several new and very interesting designs of vacuum arresters intended for telephone, telegraph, fire-alarm, cable and other low voltage protection. The popularity of the vacuum arrester in foreign countries and the results of many tests have shown that they possess considerable merit, which makes them desirable where a high type of lightning protection is required. It is a well-known fact that the vacuum arrester possesses very good insulating qualities for alternating and direct currents, and also becomes a good conducting path for light and heavy static discharges. In view of this there is a rapidly increasing demand for these arresters among telephone companies and users of low voltage apparatus where the importance of lower maintenance is appreciated.

The difficulty of maintaining a constant vacuum is entirely overcome in the Brach arrester, as the company has produced an instrument in which the vacuum chamber encloses an inner shield of mica mounted on porcelain spool heads. This mica shield receives the heat and shock of the discharge, thereby protecting the outer shell of glass. The stability of this form of construction has shown on every test that the arrester is of greater efficiency and stability than a form without the mica shield. The Brach mica shield vacuum arrester is also very serviceable for universal use, and since the vacuum tube is built in the form of a cartridge they can be installed in the regular spring fuse mountings. They also may be conveniently carried around in the pocket without



Vacuum Cartridge, Actual Size.

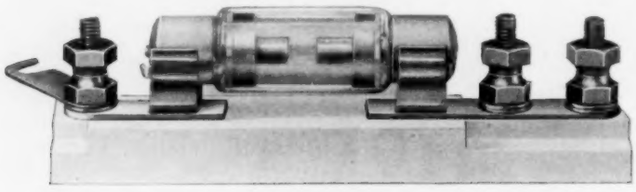


Section Through Arrester.

A, Copper Cap; *B*, Glass Shell; *C*, Porcelain Spool Head; *D*, Metal Band; *E*, Mica Shield; *F*, Electrode; *G*, Cement Filler; *H*, 4 Lead-in Wires; *I*, Exhaust Seal-off 1; *J*, Soldered Terminal.

breaking. The size of the vacuum cartridges is 3¼ inches long by 15/16 inches diameter. The Brach Company can furnish arresters in single units, pairs or in panel strips to accommodate any number of circuits. The attention of engineers and parties interested in improved protecting devices is called to this type. The company will furnish data showing the efficiency and capacity of these instruments.

The L. S. Brach Supply Company, of 143 Liberty street, New York, N. Y., is the manufacturer. The



Type 27 Arrester, Mounted.

company also manufactures the well-known non-air-gap lightning arresters and carries a full line of testing instruments for the purpose of determining the efficiency of lightning arresters in service.

Chinese Telephone Students in the United States

It has been a common thing during the last fifteen or twenty years to hear of the Japanese government sending students to pursue a course of studies in the colleges and principal manufacturing establishments in the United States. That this policy has been fruitful of results, beneficial to the Japanese as a nation, has been evidenced by their achievements in recent years—familiar to all students of contemporaneous history. Probably owing to the fact that large

Chu Fu I, Tong Kuo Tsan and Sung Pao Kien.

bodies move slowly, China had not, until a very short while ago, seen fit to take advantage of these opportunities for those of her young men who wished to embark upon professional careers. A new era, however, is dawning in the Celestial Kingdom.

For some time past, the eyes of the entire civilized world have been centered upon the political upheavals in China. In the mass of news concerning those disturbances, an incident, which will undoubtedly have a bearing upon the future of the country, is worthy of notice. During the early part of 1911, the authorities of the Government Technical College at Shanghai, or Nan Yang University, as it is now known, feeling the growth of a national telephone system to be assured, took up with the Western Electric Company's representative in China the question of sending a number of the members of the graduating class in electrical engineering to the United States for training in that company's shops.

The necessary arrangements were quickly made and after graduation in July, 1911, three men, the first ever sent out by the University for such training, left for America. They came to Chicago to the Hawthorne plant of the Western Electric Company, where they will engage in the practical study of telephony, in the company's student course. Following this, they will spend some time with one of the large operating telephone companies. Upon completion of their studies the men will, of course, return to their native land, where it is expected that they will be of material assistance in promoting and developing the telephone system of China.

The men, whose names are Chu Fu I, Long Kuo Tsan and Sung Pao Kien, are proving themselves well adapted to their future vocation and they will in all likelihood be heard from again in later years when the telephone has gained a greater hold in China.

Western Electric Gross Sales in 1911

Comparison of the year ended December 31 last of Western Electric Company is necessarily complicated since the preceding year included thirteen months, in order to bring the fiscal year to correspond with the calendar year in 1910. Taking twelve-thirteenths of the year 1910 as a basis for comparison, which, of course, is only approximate, the two years shape up as follows:

Income account:	1911	1910	Changes
Gross sales	$66,211,975	$63,115,512	Inc. $3,096,463
Other income	337,293	448,896	Dec. 111,603
Total income	$66,549,268	$63,564,408	Inc. $2,984,460
Mfg. costs, expenses	62,414,067	58,562,100	Inc. 3,851,967
Net earnings	$ 4,135,201	$ 5,002,308	Dec. $ 867,107
Interest charges	854,909	816,816	Inc. 38,093
Balance for dividends	$ 3,280,292	$ 4,185,492	Dec. $ 905,200
Dividends	1,500,000	1,569,228	Dec. 69,228
Carried to reserve	800,000	1,061,532	Dec. 261,532
Surplus	$ 980,292	$ 1,554,732	Dec. $ 574,440

Although the gross sales in 1911 showed a gain of approximately $3,000,000 over gross sales in 1910, the latter being computed on a 12-13th basis, the increase in manufacturing costs, expenses, etc., more than offset the increase in gross. The 1911 balance for dividends, however, of nearly 22 per cent is more than twice the regular eight per cent dividend rate plus the usual yearly extra two per cent.

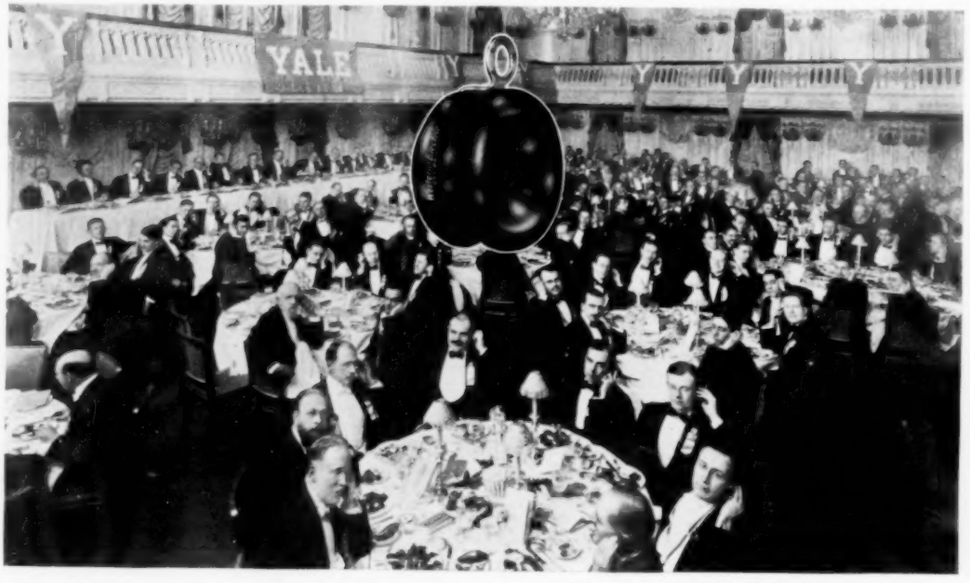
Last year was the second largest in gross sales, 1906 being the biggest with a total of $69,000,000. It seems almost certain that Western Electric will make a new high record the next two years, if not this year.

Western Electric's new balance sheet shows few changes of importance. Property account has an increase of about $500,000, standing at $10,575,000, while cash resources of $2,760,000 are about $800,000 less than a year preceding. Receivables are about $700,000 less, which is more than offset by the decrease in accounts payable of about $1,280,000. The company wrote off $800,000 in its income statement for reserve against depreciation of patents, etc., making the net surplus for the year $980,392.

An Electro-Magnetic After Dinner Speech

As a general rule, after-dinner speeches can successfully compete with so-called sleeping powders in their slumber-producing effect, unless some novelty is brought into play or some unusually eloquent or witty speaker is heard. Either alternative is difficult to find, but it has remained for the telephone to create a new interest in "we-have-with-us-tonight" oratory.

Members of the Yale Club, residing in Chicago, recently decided to hold a dinner at the Hotel Blackstone and naturally wished to hear a personal message from President Hadley of their Alma Mater. As it was not convenient for the latter to attend the dinner, and the committee thought that a letter would not convey the same spirit of warmth and good cheer, it was decided to see what the long distance telephone could do to bring about the desired results. What would have been considered an utterly foolish idea a few years ago was a comparatively simple thing for the present-day telephone engineer.



Chicago's Yale Alumni, Listening to Pres. Hadley at New Haven.

As the result of special arrangements made by the Chicago Yale Club, two direct wires were connected through from President Hadley's home in New Haven, Connecticut, to the Hotel Blackstone in Chicago, with a telephone repeater at the latter end, in order that no word of the speaker's remarks might be lost. The diners, seated in groups of eight at small tables, listened through Western Electric watch-case receivers to a most interesting five-minute speech, beginning at about 9:17 p. m. Having finished speaking, President Hadley took up a receiver on the second or listening circuit and for over half an hour listened to the songs and cheers of the merry gathering.

To President Hadley, therefore, belongs the unique distinction of having made the longest long-distance speech on record. The vista of possibilities opened up by this achievement are enormous, to say nothing of the transportation expenses saved in bringing noted speakers to the place of meeting.

Book Reviews

AITKEN'S MANUAL OF THE TELEPHONE seeks to cover the field of commercial telephone engineering in two volumes.

Volume No. 1 concerns itself first with the principle of the telephone and the development of the system in England, which is followed by a discussion of subscribers' instruments and circuits and exchange working, ranging from simple private installations through magneto and common battery exchanges, including the modern developments in automatic exchange working. This volume also includes the various systems of trunk line working.

Each subject handled is treated quite fully, attention being given to the description of early methods as well as those of the present day. In fact, one of the criticisms that might be urged against the book is that much of the matter seems somewhat superfluous in a book which is intended for the modern telephone engineer, who is more interested with present-day problems. Some of the illustrations also seem to be unnecessary in a book intended for professionals, and in some cases the illustrations are not numbered consecutively, which tends to cause confusion.

While the book as it is will be valuable as a work of reference to telephone men everywhere, still in many instances it enters into details which might be eliminated without detracting from its value, and it could then be produced at a less price which would give it a broader circulation among telephone men. Volume II is not yet completed.

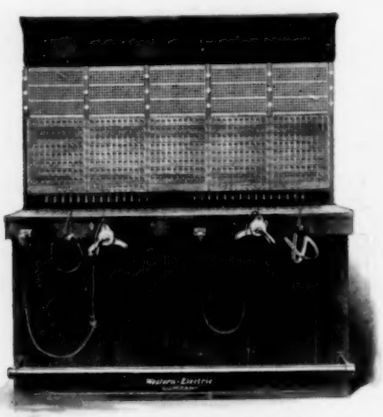
Half leather, 675 pages, published by "The Electrician" Printing and Publishing Company, Ltd.

The Post and Telegraph Department, Brussels, Belgium, has called for tenders for the installation of a telephone switchboard and accessories. Specification No. 1108 may be obtained from the Bureau des Renseignements, 15 Rue des Augustins, Brussels, Belgium.

A New Magneto Multiple Switchboard.

It has been announced by the Western Electric Company that, in response to the many requests made for such equipment, its engineers have recently completed the development of a magneto multiple switchboard with a jack for every line within easy reach of each operator. The new switchboard, known as the No. 1013 type, is designed for use on local battery magneto telephone systems where, on account of local conditions, a central battery board would be out of the question.

The No. 1013 switchboard is intended for telephone systems having an ultimate capacity of 1,500 lines or less and where the traffic conditions make it necessary to take advantage of the inherent rapidity and efficiency of operation obtained with a multiple switchboard. The sections are five panel, two-position, and, when lined up in the operating room, present the appearance of one continuous cabinet. A



New Magneto Multiple Switchboard.

cable turning section with a terminal rack is provided for the head end of the switchboard line-up, matching the other sections in design and finish.

The line and cord circuit apparatus makes use of the familiar No. 4 type combined jack and signal, with the red spherical shutter. The multiple jacks are mounted in strips of twenty, each jack being on an individual frame so that any one may be removed at will. Each jack has a hardened German silver sleeve, thus reducing wear to a minimum. The clearing-out signal or supervisory signals are modified combined jacks and signals in which the jacks have been replaced by push buttons for restoring the signals. This provides positive supervision.

Bulletin No. 1022 describes the new switchboard and its circuits in detail. Copies will be forwarded by the company in response to inquiries.

Improvements to Follow Michigan Merger

Improvements involving an expenditure of approximately $125,000 are contemplated for Muskegon, Mich., by the Citizens' Telephone Company. The work of installing them will be commenced as soon as the merger with the United Home Telephone Company of Ludington is approved by the state railroad commission, and certain amendments to the charter from the city are secured.

Embraced in the list of contemplated improvements is the erection of a two-story brick building on Terrace street. The land has already been purchased, and the plans for the structure are completed. When finished, the building will be one of the finest telephone company homes in western Michigan.

The structure will be of pressed white glazed brick with ornate trimmings. It will eventually be used as the headquarters of the consolidated companies. At present, the chief offices of the new organization are at Ludington, but Thomas Bromley, Jr., the manager of the merged systems, has already established himself in Muskegon and is now directing the affairs of the business from there.

The application for permission to merge the Ludington and Muskegon companies is now pending before the state railroad commission, and action on the petition is expected at any time. In asking that the consolidation be allowed, representatives of the two corporations also requested that the new one be privileged to make an increase of the capital stock.

Helps for the Business Man

There are to-day many business men who unfortunately for themselves, are doing without many things which would enable them to work in greater comfort and, in general, conduct their business with increased efficiency. That such a state of affairs exists is not the fault of the business men but rather due to the fact that they have not been told in the right way. Realizing this, the Western Electric Company has recently published an attractive little book aptly named "The Silent Partners — A True Story."

The book, written in an easy, colloquial style, is so convincing that the reader wants to invest in everything described therein. The advantages of Western Electric Inter-phones as time and step savers; of desk, bracket, ceiling and counter fans as creators of coolness; of ventilating or exhaust fans as fresh air producers and of large and small motors for shop and factory use, are set forth cleverly.

The British Columbia Shipowners' Association and the local shipmasters' association are urging the dominion government to establish a telephone line along the coast between Powell river and Vancouver, similar to telephone lines along the St. Lawrence river and other shores in the east, which could be used in emergencies.

The Important Detail

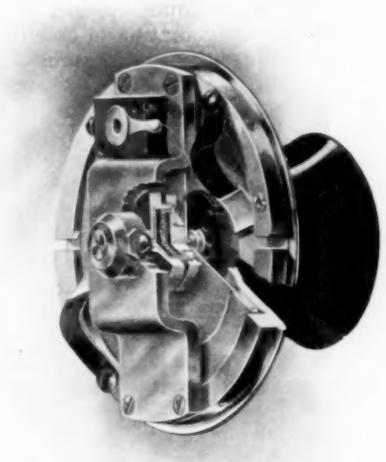
There is a little nursery rhyme which has come down through the ages. It reads:

Little drops of water,
Little grains of sand,
Make the mighty ocean
And the pleasant land.

In speaking of transmitters recently, a Western Electric Company man, familiar with the manufacture of that all-important factor of telephony, suggested that the verse might well be changed a bit to read:

Big and little details,
Made with wondrous skill,
Help to make transmitters
Send your speech at will.

During the past decade, the public has come to accept the telephone as an every-day sort of thing, good for talking to some one else miles away; but owing to the familiarity which such continued speaking acquaintance has bred, has probably never given a thought to the delicate workmanship necessary to turn out a transmitter which will really talk well.



The Transmitter.

The transmitter is made up of fifty-nine details or parts, not including over fifty thousand granules of carbon, which are encased in a closed cup and form what might be termed the "dynamo" of the instrument. Each detail of the transmitter is made as carefully as the most delicate part of an expensive watch. The average person, rarely dealing with dimensions less than one-eighth of an inch, will scarcely realize what it means to manufacture very small parts whose dimensions must not vary more than one-thousandth of an inch either way. The outside of the transmitter is compact appearnig and strongly built. This is necessary on account of the fact that it is the housing for the "details made with wondrous skill."

Through the medium of delicately manufactured Western Electric instruments, it is now possible to transmit speech from New York to Denver, a distance of 2,050 miles. Less carefully made transmitters would fail utterly in such a project. In a short time the line will be extended to San Francisco, when, if the hopes of the telephone engineers who are engaged in the work are realized, the dream of transcontinental telephone communication will have come true.

Chase Business Increasing

At the last meeting of the stockholders of the Chase Motor Truck Company of Syracuse, N. Y., it was voted to double the capital stock, making the capitalization $300,000 instead of $150,000, as it has been for some time past. This increase is in line with the general development of manufacturing facilities which have been going on in the company for the past four months. Judged by the amount of business done last year and the orders that have been coming in for the last few months, it was thought that the capitalization of the company bore too small a proportion to the scope of business. The company reports good business conditions in all sections of the country, particularly in the middle west and the northwest, where the demand for Chase trucks has been constantly increasing ever since the first of the year. For some time past the Chase Motor Truck Company has been planning extensive additions to its present manufacturing facilities, but is not prepared as yet to more than outline what these will be. The new factory addition in Wyoming street, completed the first of the year, was very early found inadequate to take care of the advanced volume of business. It is expected that the plans under way at the present moment, if carried out, will be sufficient for some time to come.

The Chase company reports a record business for the month of March. Numerous repeat orders have been received, and the outlook for spring business, judged by actual orders in hand, is even better than was anticipated. Early in the month the Chase dealers in Minneapolis, Minn., the Chase Motor Truck Sales Company, placed an order for sixty-two Chase trucks, of which six were going as soon as delivered to the Dakota Central Telephone Company at Aberdeen, S. D.

Chicago Council Votes $5,000 for Inquiry

An appropriation of $5,000 has been recommended by the Chicago council finance committee for an investigation of the telephone properties of the Illinois Tunnel Company. It has been charged the company failed to comply with the provisions of its franchise and have 20,000 bona fide subscribers to its automatic telephone service on June 1, 1911.

Alderman Pringle has been active in agitating the matter, and through his efforts a representative of the city appeared in the federal courts when the company's properties were sold and stated that the city did not admit that the company complied with its franchise.

Nathaniel C. Sears, attorney, said to the committee that it was doing the company an injustice in making the appropriation. He also said the city had seriously hampered the company in its efforts to install telephones. The committee asked the city's legal department to investigate the alleged delays.

E. W. Bemis, the city's public utility expert, attended a meeting of the council gas, oil and electric light committee and said considerable time will elapse before his

report on the Chicago Telephone Company will be ready for publication.

Mr. Bemis said he is waiting until the company's experts have finished their work of appraising equipment, etc., and that he will be unable to finish his report until that time.

The committee discussed the question of telephone meters, but took no action except to order Mr. Bemis to make further investigations of the practicability of telephone recording devices.

Johnston Electric Company Reorganized

By the reorganization and enlargement of the Johnston Electric Company into the Midwest Electric Company, just announced, Omaha, Neb., secures one of the largest electrical supply houses west of Chicago. While the location will remain the same for the present, the stock and trade facilities will be greatly increased, and an almost entirely new management will push the business into a larger territory than before.

George A. Seabury will be the secretary and general manager of the new concern. He has for several years been connected with the General Electric Company, the last few years as manager of the Kansas City branch. H. J. Coleman is added to the force in the capacity of illuminating engineer, and Ned McCue is an addition to the sales force.

George W. Johnston, the founder of the late company, and for twenty-five years in the electrical supply business in Omaha, remains with the new company as its president. Mr. Johnston several years ago founded the Western Electrical Company, the name of which was changed five years ago to the Johnston Electrical Company.

Owing to the rapid growth of the electrical business generally during the last quarter of a century, the jobbing and supply houses in this line have grown with it, especially in this rapidly developing part of the country. Mr. Johnston has not only kept pace with the growth, but with the increased size and capitalization of the new organization, will be in position to make Omaha the principal electrical supply point of the west.

Factors in Foreign Trade

The Bureau of Manufactures, Washington, D. C., now has in press a bulletin that will no doubt find a permanent place on the desk of every manufacturer interested in foreign trade. In its 56 pages will be found answers to questions asked by every manufacturer sending out trade literature or opening correspondence with foreign firms: What language is it best to use? In what currency and what weights and measures should prices be quoted? What postage should be placed on the catalogue or the letter? Can I prepay a reply from the prospective customer? Is there a parcels post?

The bulletin answers these and other questions for each country in a concise manner, the reader can put his fingers on the information sought without hunting through a mass of detail that he does not want. Supplementing these statements are tables for converting the money of foreign countries into that of the United States; also a comparison of prices for countries in which both the monetary unit and the units of weight and measure differ from those used in the United States. For example, the latter tables show the reader at a glance what is the comparative price per meter in Mexican currency of a cloth quoted at 50 cents per yard in United States currency; or the price per pound in United States money of an article quoted at 30 francs per kilo in French currency.

Currency conversion tables and price comparisons are given for over 30 countries. Foreign postage rates and the parcels-post regulations are summarized, and a list is given of the countries in which international reply coupons are valid.

Copies of the bulletin, which is entitled "Factors in Foreign Trade," will be available for distribution at an early date, and those desiring it should make application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

Portable Sound Proof Telephone Booths

It is a notable fact, and generally remarked, that the use of sound-proof telephone booths is being rapidly extended. Telephone engineers agree that a means for private conversation is essential to the best service of a public station. Persons within hearing distance of a public telephone will often deter a possible patron from using it, owing to the private nature of the intended communication. No doubt each day there are thousands of such possible patrons who would add materially to the income of the telephone company if the service of its pay stations also included absolute privacy. That the sound-proof booth is a profitable investment has been proven conclusively wherever it has been placed.

After considerable experimental and research work, a practical sound-proof booth for telephone service has been developed. The booths have double, interchangeable walls, with an air space between, which excludes outside noises and secures privacy. They are mounted on rubber cushions.

Only selected lumber, thoroughly seasoned and kiln dried, is used in the manufacture of these booths.

The doors can be furnished in either the single or double pattern to swing to the right or left, as desired. Wooden panels are interchangeable with glass sashes, which are removable to facilitate cleaning. Compartment booths can be supplied in any number desired. The compartments are independent and sound insulated, though the outside appearance is as of one booth. Stools, curtains and rugs can also be furnished to suit any model or size.

Bulletin No. 1083, issued by the Western Electric Company, describing in detail a complete line of booths, will be sent by the company to any one interested.

Telephone Company to Aid Farmers

A seed warning is to be telephoned by the Northwestern Telephone Exchange Company to 50,000 farmer subscribers. The order will be carried out through district managers. The warning is the result of the discovery by the state agricultural college that the seed corn germination is from 10 to 60 per cent, while 90 per cent is the normal standard. The telephone company will urge the farmers to test their seed corn before

planting. The cause of the trouble, says Superintendent A. D. Wilson of the extension division of the college, was the wet fall of 1911, so that the corn did not have a chance to dry out before frost. The telephone company has asked reports from farmers as to whether they will plant corn, whether they will test it, and the result when tested.

Enterprise of Chicago Automatic

Not content with furnishing the time of day by phonograph, the Illinois Tunnel Company, Chicago's enterprising independent telephone utility, has inaugurated a baseball score service. Any impatient fan who has access to an automtic telephone can, by calling No. 549, and listening without talking, get the score at the moment. This feature of the service is made possible by co-operation with the Chicago *Examiner's* baseball information bureau.

The company is also sending out a list of 127 towns in Illinois, 55 in Indiana, 31 in Iowa and 54 in Michigan, with which it connects over independent copper toll lines.

Wisconsin Commission News

That a ruling of the railroad rate commission supersedes a city ordinance in certain cases is a decision of the Wisconsin Supreme Court. Free telephone service by franchise agreement was furnished by a local company to Kenosha city department from 1905 to 1908. That the public utilities act of 1907 forbade free service was the contention of the telephone company and the railway rate commission. This point was upheld by the court.

South Carolina Commission News

The South Carolina railroad commission has named May 2 as the date for the hearing on the telephone situation in Spartanburg. The hearing will be held in Columbia and was granted upon request of the Southern Bell Telephone Company.

The company is asking for permission to increase the rate by 50 cents per month each telephone on the condition of certain improvements which will cost approximately $150,000.

Half-Cent a Mile Toll

Application has been made by the Pacific Telephone and Telegraph Company to the California State Railroad Commission for permission to charge long distance telephone rates by the mile. With the commission's consent, it will establish a rate of half a cent per air-line mile, with an additional five cent terminal charge for a one-minute conversation.

H. R. Van Deventer and R. M. Warren, who have shops and laboratories at Sumter, S. C., have issued a booklet devoted to the subjects of Patents, Perfecting Inventions, Models, and the Development of Ideas. The known reliability of the members of this firm and their experience and facilities in their chosen line of work, make their announcement very important to inventors.

Picture Frame Microphone Used Years Ago

The general publicity now being given the dictograph as an aid in detective work has drawn attention to the use made, for the same purpose, of ordinary telephone apparatus by a detective several years ago. During a corporation controversy an important meeting of one of the opposing factions was to be held in a committee room, and as it was of great importance that the other faction should know what was going on, a detective was called in to formulate some scheme. He appealed to a telephone man for help, and several carbon transmitters were mounted on the backs of the pictures hanging on the walls, the transmitter fronts being pressed against the paper and glass, which latter acted as a large diaphragm, so sensitive that the merest whispers could be heard at the receiver end in another room. Exceptionally small copper wires were used for transmission, carried along the picture molding and around the wire used to hang the pictures.

Application has been made by an individual to a Latin-American government for a concession for the establishment of telephone service in various cities. The conditions of the concession applied for include exclusive privilege for twenty years of placing the necessary posts and wires in the public roads, the importation free of duty of wire, switches, and other telephone apparatus. In case this application is granted there is likely to be a considerable demand for telephone apparatus and equipment. Address Bureau of Manufactures, Washington, D. C., File No. 8359.

The Diamond Expansion Bolt Company, New York, has issued a 52-page catalogue of its product which not only lists and illustrates an immense variety of expansion bolts, drills, brackets, toggles, cable clamps and rings, duct rods, ground clamps, guy clamps, etc., but gives instructions for their use. The catalogue will suggest to telephone men a great number of possible uses whereby they can save time, labor and material.

The Sumter Telephone Manufacturing Company, Sumter, S. C., is sending out a circular describing the Mason multi-discharge arrester. This device has a number of advantageous points, and those interested in the use of arresters should familiarize themselves with it.

A circular captioned "The Live Wire," issued by the Thompson-Levering Company, Philadelphia, brings information and news about Peerless test sets of both the dial and plug type. The company invites inquiries for its descriptive bulletins.

"Copper wire at ten cents a pound" is the catchy caption employed by the Duplex Metals Company, Chester, Pa., in calling attention to the economies of copper clad steel tie wire.

The postmaster general, Perth, Western Australia, has issued a call for tenders for the supply of common battery telephones (schedule No. 190). Details are not supplied.

Brevities of the Business

PERSONAL NOTES.

Earl Wasson, son of B. F. Wasson, president of the National Telephone and Electric Company, has been appointed manager of the company at Farmer City, Ill., succeeding Charles Costley, resigned.

A. J. Heller has been appointed manager of the Central Union Telephone Company's exchanges at Bowling Green and Cygnot, Ohio, succeeding B. E. Allen, recently deceased.

W. T. Halfrich, until recently in charge of the Wisconsin Telephone Company's exchange at Merrill, Wis., has been appointed manager of the company's exchange at Ashland, succeeding F. J. Huotte, resigned.

F. C. Gallagher has been appointed manager of the Butler-Bremer Mutual Telephone Company, Plainfield, Iowa.

H. J. Pettengill, for some years with the Postal Telegraph Company, but more recently with the Southwestern Telephone and Telegraph Company, Dallas, Texas, has been elected president of all the Bell telephone companies southwest of St. Louis, with headquarters in that city.

C. A. Gates, recently appointed general manager of the Southwestern Telephone and Telegraph Company, began his telephone career in 1885 as night operator in Saginaw, Michigan. Fifteen years later when he had reached the position of general superintendent for the company with which he started at the bottom, he was induced to accept a position with the Southwestern Telephone and Telegraph Company where he was placed in charge of long distance service, then in its infancy. So well did he do his work that he was placed in charge of all traffic, both local and long distance and given the title of traffic manager. In 1904 he was appointed general superintendent which position he filled for five years. When the company was reorganized in 1909 he was made general superintendent of plant and under his hand as a builder the system which he has now been called upon to operate assumed its present proportions.

Franklin H. Reed, formerly editor of *Telephony*, has severed his connection with that publication and has connected himself with the Traffic Service Bureau, of Chicago and Washington. He will have charge of *Public Service Regulation*, the official organ of the National Association of Railway Commissioners. Previous to entering the publication field Mr. Reed spent several years in public utility operating and engineering work and for the past few years he has given special attention to the subject of public-utility regulation.

A. R. Marsters has been elected secretary of the American Telephone and Telegraph Company, suceeding Charles E. Hubbard.

Charles F. Adams, G. P. Gardner and Richard Olney have been elected directors of the American Telephone and Telegraph Company to succeed Thomas Sanders, deceased and Thomas B. Bailey and Frank E. Warren, resigned.

L. A. Gary, a telephone engineer of Los Angeles, has been elected an associate member of the American Institute of Electrical Engineers.

D. R. Linsley, formerly with the Pierce-Arrow Motor Car Company, Buffalo, N. Y., has acepted a position as salesman with the Chase Motor Truck Company. He will make his headquarters at Syracuse and travel through central and northern New York.

E. F. Howell, Buffalo, N. Y., has been appointed disrtict manager for the Chase Motor Truck Company. He will make his headquarters at the Philadelphia branch of the company, 1351 Ridge avenue, and his territory will include portions of Maryland, Pennsylvania and New Jersey, also the entire state of Delaware. Mr. Howell has just resigned from the sales department of the Buffalo branch of the Diamond Rubber Company with which he has been connected for the last three years.

L. M. Grimes of Des Moines has been appointed auditor of the Iowa Telephone Company to succeed E. M. Halderman, who has been appointed auditor of disbursements for the Bell system in Iowa, Nebraska, Minnesota, North Dakota and South Dakota with headquarters in Omaha.

Richard Dean has been promoted from the position of foreman to division superintendent of the Cumberland Telephone and Telegraph Company at New Orleans. Mr. Dean has been in the employ of the company some years and has filled various positions.

T. J. Rogers recently resigned as manager of the Hardin County Home Telephone Company, Elizabethtown, Ky., and has accepted a position with the Home Telephone Company of Louisville. He will be succeeded at Elizabethtown by J. Paul Quiggins.

A. S. Duncan and A. Podmore, members of the National Telephone Company's engineering staff who were transferred to the postoffice, have been appointed assistant electrician and assistant engineer respectively, to the Constantinople Telephone Company (Societe Anonyme Ottomans des Telephones de Constantinople), and will shortly proceed to Constantinople to take up their duties.

John Young has been appointed manager of the Mutual Telephone Company, Hopkins, Mo.

J. C. Danielson for the past four years president of the Lamoni Telephone Company, Lamoni, Iowa, has severed his connection with that company and Charles France has been elected president and manager to succeed Mr. Danielson.

D. P. Fullerton, division superintendent of plant, central division of the Pacific Telephone and Telegraph Company, has been appointed corresponding secretary of the Telephone Pioneers of America.

Owen E. McMahon, formerly foreman of the Elgin district of the Chicago Telephone Company, has been promoted to the position of division foreman of plant construction for Kane, McHenry and DuPage counties and all of Cook county outside of Chicago. The promotion carries with it increased responsibility as well as a substantial increase in salary.

Frank Coe, who has for some time been connected with the Independent Telephone Company at Schenectady, N. Y., has been appointed manager of the Interstate Telephone Company at Little Falls, N. Y.

NEW TELEPHONE COMPANIES.

SEALE, ALA.—A telephone company has been organized in this place with B. G. Jennings as president and L. J. Lewis, secretary-treasurer. An exchange will be installed at an early date.

LOCKESBURG, ARK.—A movement is on foot to organize a telephone company with a capital stock of $50,000 which shall cover all of Sevier county and have headquarters in this place.

ONTARIO, CAL.—Articles of incorporation have been filed for the Ontario-Upland Telephone and Telegraph Company with a capital stock of $100,000. The officers are as follows: President, R. B. Campbell; vice-president, W. A. Freemire; secretary and treasurer, H. M. Robinson; manager, R. Grant White. It is the purpose of the company to combine the two local systems and also to put in systems and connecting lines in Upland and other cities.

STOCKTON, CAL.—The Stockton Telephone Company has been incorporated with a capital stock of $5,000 by Amos T. Carr, Mary S. Carr and Chauncey G. Warren.

VANCOUVER, B. C., CAN.—The Coquitlam Telephone Company, Ltd., has been incorporated with a capital stock of $50,000.

SUMMERLAND, B. C., CAN.—The Summerland Telephone Company, Ltd., has been incorporated with a capital stock of $50,000 with headquarters in this city, for the purpose of constructing and maintaining telephone service in Yale county.

BOISE, IDAHO.—The Sunnyside Telephone Company of Nez Perce county has been incorporated with a capital stock of $1,000 by J. H. Johnston, I. J. Johnston, C. Powell, J. M. Frisbee and Charles Swartz.

KAPPA, ILL.—The Kappa Telephone Company has been incorporated by J. B. Drake, F. E. Dixon and Jacob Metzger with a capital stock of $500.

ROCK ISLAND, ILL.—The Tri-City Automatic Telephone Company has been incorporated with a capital stock of $1,000,000 by Henry C. Struck of the Davenport Savings Bank, L. S. McCabe of L. S. McCabe and Company of this city, Dr. P. H. Wessel, former mayor of Moline and Bryan H. Osborn of Franklin, Pa. The company has applied for a franchise in Davenport.

MEREDOSIA, ILL.—A new telephone company to be known as the Farmers' and Merchants' Exchange has been organized with the following officers: President, C. D. Kappel; vice-president, William Meier; secretary and treasurer, Louis F. Berger; directors, William Duvandack, Charles Schlicker, Riney Steinberg and Clyde McAllister. It is the purpose of the new company to purchase the local exchange.

TIPTON, IND.—The citizens of Kempton and vicinity have organized a co-operative telephone company with the following directors: Jesse F. Mott, Charles Fearnow, John H. Goodnight, Irvin Wheatley, Alpheus Ort, Everett Bunch and Harry Barnett.

Over $7,000 in stock has been subscribed. An effort will be made to purchase the Kempton plant.

OCONEE, ILL.—The Oconee Telephone Company has been incorporated by H. F. Grote, J. A. Werner and J. W. Patterson; capital stock $2,000.

NEW LONDON, IND.—Articles of incorporation have been filed for the New London Co-operative Telephone Company with a capital stock of $3,000. The incorporators are E. S. Mendenhall, W. F. Newby and A. T. Cosand.

BELLVIEW, IND.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000 and the following directors have been elected: Dawson Smith, Charles King, Wiley Tague, David Stevenson, John Highly, Joseph Risk, Corty Brinson, Thomas Miller, Ray Bushman Walter Day, William Konkle, Charles Geisten, David Gordon, Charles E. Taylor and Charles E. Cleek. The company will install a telephone plant in this place and extend the lines throughout Jefferson and Ripley counties.

MOORHEAD, IA.—The Sioux Valley Telephone Company has been incorporated with a capital stock of $400 by A. McElwain, Charles Seaton and John Hansen.

THAYER, IA.—The Eastern Union Telephone Company has been incorporated at this place with the following officers: President, M. Early; vice-president, H. T. Goodridge; secretary, Daniel Swindler; treasurer, Fred Neismier.

GILBERT, IA.—The Gilbert Telephone Company has been incorporated with a capital stock of $10,000 by H. Sawyer, A. Jones, F. Orning and others.

CALDWELL, KANS.—The Caldwell Southwestern Telephone Company has been incorporated by S. F. Eiswander, G. W. Wogeman, J. R. Elmore, P. J. Bohn, Marion Bossett and J. H. Atkinson, all of Caldwell; capital stock $690.

DENNIS, KANS.—The Dennis Telephone Company has been incorporated with a capital stock of $6,000.

BARTLETT, KANS.—The Hackberry Mutual Telephone Company has been incorporated with a capital stock of $2,000.

HOISINGTON, KANS.—The Hoisington-Stickney Telephone Company has been incorporated by Frank Gage, A. H. Royle and others with a capital stock of $1,000.

SEDGWICK, KANS.—Articles of incorporation have been filed for the Sunflower Telephone Company with a capital stock of $2,000, by Theodore C. Coffman and Martin J. Brower.

MCLOUTH, KANS.—The McLouth Mutual Telephone Company has been incorporated by J. W. Harding, J. H. Jones and others.

OLIVE HILL, KY.—H. R. Dysard, W. B. White and A. J. Stamper have incorpated the Big Sandy Telephone Company with a capital stock of $10,000.

MONTROSE, MICH.—The Montrose Home Telephone Company has been incorporated with a capital stock of $1,000.

LESLIE R. F. D., MICH.—The Bunker Hill Telephone Exchange has been incorporated by Philip Stiles, Lou Neu, Delbert Blackmore and others, with a capital stock of $6,000.

PERRINGTON, MICH.—Articles of incorporation have been filed for the Perrington Independent Telephone Company with a capital stock of $5,000. The incorporators are Charles H. Wininger, Philip Petters, Richard Butler and others.

STRATHCONA, MINN.—The Trans-Siberian Rural Telephone Company has been incorporated by John Stramer, C. H. Nordby and Herman Spjut, with a capital stock of $1,500.

KELLIHER, MINN.—A telephone company is being formed by Wm. Burce, and Wm. Lennon of this city and B. W. Lakin and A. G. Wedge of Bemidji to install a local exchange and give service throughout the vicinity.

STEPHEN, MINN.—The Sinnott-Augsburg Telephone Company has been incorporated with a capital stock of $6,000, and the officers are as follows: President, J. W. Field; vice-president, S. P. Jensen; secretary, John Whalen; treasurer, P. F. Benson.

WHITE ROCK, MINN.—G. O. Miller, Arthur L. Swenson, Ernest T. Swenson, Andrew J. Larson and Free Swenson of this place have incorporated the G. O. Miller Telephone Company with a capital stock of $50,000.

BROWERVILLE, MINN.—The East Hartford Telephone Company has been incorporated with L. I. Baron, Jr., president and Theodore Johnson, secretary.

STEPHEN, MINN.—Articles of incorporation have been filed for the Stephen Red River Telephone Company with a capital stock of $6,000. The officers are as follows: President, George W. Eastburn; vice-president, C. R. Wyse; secretary, F. C. Woods; treasurer, Jules Pagnac.

PONY, MONT.—Articles of incorporation have been filed for the Summit Valley Telephone Company with a capital stock of $5,000. The incorporators are Jacob P. Lieb, James I. Wetzel, John W. Drake, Isaac Patrick and Robert Watt.

DE SOTO, MO.—The Jefferson County Telephone Company has been incorporated with a capital stock of $3,000 by James A. Bage, S. J. Bage, James F. Steel and others.

CHINOOK, MONT.—The North Fork Telephone Company has been incorporated with a capital stock of $5,000 by Peter Denny, Ben Ripley and R. F. Hanson, Shelby, Mont. Articles of incorporation have been filed for the Farmers' Telephone Company with a capital stock of $10,000.

FORSYTH, MONT.—Articles of incorporation have been filed for the Rosebud Mutual Telephone Company which will construct a telephone line between this place and Rosebud.

JAVA CENTER, N. Y.—Articles of incorporation have been filed for the Java Telephone Company by E. J. Conroy, Lizzie M. Conroy and John R. Griffith; capital stock $2,500.

STEDMAN, N. Y.—The Stedman Telephone Company has been incorporated by Myron Whitney, Sherman; William D. Halladay, Chautauqua; Walter R. Pettitt, Ashville; capital stock, $2,000. It is the purpose of the company to establish telephone service between Stedman and other points in the county.

STOCKTON, N. Y.—Articles of incorporation have been filed for the Stockton Telephone Company; capital stock $5,000. The directors of the company are Amos T. Carr, Mary S. Carr, C. G. Warren, L. W. Lazell and J. D. Crisset.

CHENEY, NEB.—The Cheney Telephone Company has been incorporated with a capital stock of $2,000.

PLEASANTDALE, NEBR.—Articles of incorporation have been filed for the Ringgold Mutual Telephone Company; capital stock $1,200.

LINCOLN, NEBR.—Orison Field, L. E. Childs, C. F. Krenzien, Henry Martin, H. G. Elkoff and B. F. Holton have made application for a charter for the St. Clare Mutual Telephone Company. The company is capitalized at $10,000, one-fifth of which is fully paid in. The company is an Antelope county concern and the stockholders are in the main farmers living in the vicinity of Tilden.

CARSON CITY, NEV.—The Interstate Telegraph Company has been incorporated under the laws of California with a capital stock of $100,000. The company proposes to construct telegraph lines in both states and will have its headquarters in this city.

ARNOLD, N. C.—The Enterprise Telephone Company has been incorporated with a capital stock of $5,000 by J. A. Jordan, Junius Hill and others.

R. F. D. No. 2., UNIONVILLE, N. C.—Articles of incorporation have been filed for the Pleasant Hill Telephone Company by H. W. Williams and others; capital stock, $5,000.

FARGO, N. D.—The River Line Telephone Company has been incorporated with a capital stock of $1,300. The directors are W. W. Cook and Emil Headland of Fargo and Frank McKenzie of Wild Rice. A line will be constructed from Fargo to Wild Rice.

HETTINGER, N. D.—The Hettinger and Cedar River Telephone Company has been incorporated with a capital stock of $10,000. The directors are William W. Anderson and Andrew W. Anderson of Hettinger and Maurice Donnely of Indianapolis, Ind.

NAPOLEON, O.—The Napoleon Telephone Company is the name of the organization incorporated to take over and operate the plant of the Home Telephone Company of this city which was purchased at receiver's sale some time ago for $25,000. The incorporators are W. L. Parmenter, B. B. Applas, M. Brenneman, Wallace Landis and John Cable, all of Lima. The holdings of the new company comprise the local telephone exchange and several tributary lines in the county. The capital stock of the new corporation is $50,000.

ASHLAND, O.—The Ashland Telephone Company has been incorporated with a capital stock of $125,000 by W. B. Seaton, Charles F. Weaver, Charles Russell, John Russell and Harold Means.

TOLLSBURG, O.—Articles of incorporation have been filed for the Louisa and Webbville Telephone Company with a capital stock of $1,000 by R. Collinsworth, John Hall and W. V. Roberts.

CANADIAN, OKLA.—The Pittsburg County Telephone Company has been incorporated with a capital stock of $1,000 by D. L. Roe, W. L. Belt, F. G. Gillock, T. D. Luper, W. P. Lewellen, M. W. Priddy, J. L. Wood, J. D. Fulton and W. A. Byers.

OOLOGAH, OKLA.—The Oologah Telephone Company has been incorporated with a capital stock of $1,500; directors M. O. Swan, E. F. Young, and F. E. Caulstrom.

MARLOW, OKLA.—The Marlow and Big Beaver Telephone Company has been incorporated with a capital stock of $1,000 by Harley Peters, C. D. Julian, P. C. Hockenburg and W. H. Dunn, all of Marlow.

SEASIDE, ORE.—Articles of incorporation have been filed for the Mutual Telephone Company with a capital stock of $2,500. The incorporators are W. D. Torrey, A. J. Gregg, and I. N. Fleischner.

FOYIL, OKLA.—The Blue Creek Rural Telephone Company has been incorporated with a capital stock of $575 by B. F. Matthews, W. C. Skelton and J. E. Lafferty.

PIKETON, PA.—The Blue Mountain Telephone Company has been incorporated with a capital stock of $5,000 to supply telephone service to the farmers of lower Dauphin county and into Oberlin and Penbrook.

BIRDSBORO, PA.—A telephone company to be known as the Robeson Rural Telephone Company, has been organized for the purpose of building lines in the rural communities of Southern Berks, and to the towns of Robeson, Gibraltar, Seyfert and other towns.

BETHUME, S. C.—The Bethume Telephone Company has been incorporated with a capital stock of $1,000 by H. H. Holder, C. O. Terry, J. A. Stone and H. W. Northcutt.

RIDGELAND, S. C.—The secretary of state has issued a charter to the Jasper Telephone Company with a capital stock of $5,000. The officers are: President, C. E. Penny; vice-president, D. O. Fleming; secretary, J. P. Wise.

MARION, S. D.—Articles of incorporation have been filed for the Rosefield Telephone Company with a capital stock of $15,000. The incorporators are Ben C. Graber, Jacob E. Graber and Jonathan P. Graber, all of Marion.

GAYVILLE, S. D.—Peter Lund and others have incorporated the Gayville Telephone Company with a capital stock of $5,000.

FAITH, S. D.—O. E. Balch and C. P. Hussey of Faith and J. S. Cochran, of Arrowhead, have incorporated the Faith Telephone Company with a capital stock of $25,000.

RULEVILLE, TENN.—Articles of incorporation have been filed for the Burl Bayou Telephone Company with a capital stock of $10,000. The incorporators are J. W. Riddell, T. H. Brown and others.

BEXAR, TENN.—The Bexar Telephone Company was recently organized with J. A. Bradford, president, and J. W. Webb, secretary.

CASTROVILLE, TEX.—The Medina and San Geronimo Telephone Company has been organized in this place with a capital stock of $6,000.

GOLDTHWAITE, TEX.—The Brown Telegraph and Telephone Company has been organized here; capital stock, $15,000.

DEL RIO, TEX.—The Comstock and Langley Telephone Company has been incorporated with a capital stock of $2,000 by Robert W. Prosser, L. Rust and W. H. Dodd.

SALMON, TEX.—The Farmers' Union Telephone Company has been organized in this place and will maintain a local system.

JOSEPH, UTAH.—The Joseph Telephone Company has been incorporated with a capital stock of $4,000. The officers of the company are as follows: President, Jesse Willes; vice-president, James A. Ross; secretary and treasurer, John A. Parker.

MORONI, UTAH.—Articles of incorporation have been filed for the Moroni Telephone Company with a capital stock of $3,000. The officers are: President, Edward Johnston; vice-president, Jabez Faux, Jr.; secretary, E. D. Anderson; treasurer, Andrew Anderson.

SPANISH FORK, UTAH.—The Leland Electric Light and Telephone Company has been organized with the following officers: President, Benjamin Isaac; vice-president, Arthur Snow; secretary and treasurer, Perry Thomas.

RICHMOND, VA.—The American Telephone Cabinet Company has been incorporated with a capital stock of $100,000 for the manufacture of telephone cabinets. The incorporators are Morgan R. Mills, president; William B. West, vice-president; George W. Lancaster, secretary and treasurer; capital stock $100,000.

SEATTLE, WASH.—The Globe Telephone Company has been incorporated with a capital stock of $1,000,000 by C. W. McGonigle, J. B. Wheat and George W. Hemple for the manufacture and sale of all kinds of telephone equipment.

COLFAX, WASH.—The Whitman County Telephone and Telegraph Company, Ltd., has been organized and application has been made for charter; capital stock $100,000. The officers are: President, Will R. Hegler, Lamont; vice-president, G. T. Smith, Penawawa; secretary-treasurer, F. R. Rogers, Colfax; directors, the above officers and J. A. Carmin, La Crosse; Charles Burman, Pullman; A. D. O'Kelley, Albion; B. A. Atherton, Pullman; J. J. Miller, Colfax, and W. W. Robinson, Moscow, Idaho.

MEADOW BLUFF, W. VA.—The Meadow Bluff Mutual Telephone Company has been incorporated with a capital stock of $5,000 to own and operate telephone lines in Greenbrier, Nicholas, Pocahontas, Monroe, Summers and Fayette counties; incorporators, Wm. H. McClung, G. Martin, H. E. Sharp, and W. B. Jones.

GASSAWAY, W. VA.—The Gassaway Telephone Company has been incorporated with a capital stock of $10,000 by David Frame and C. W. Marple of this place; J. J. Stalnaker, of Progress; May M. Frame, of Sutton, and C. N. Snodgrass, of Rosedale.

RICHMOND, W. VA.—Articles of incorporation have been filed for the Mutual Telephone Company of Henry, Franklin and Pittsylvania counties with a capital stock of $5,000. The officers are: President, A. G. Reynolds, Vashti; vice-president, G. T. Bondurant, Figsboro; secretary and treasurer, R. W. Pedigo, Figsboro.

GRATIOT, WIS.—Articles of incorporation have been filed by H. W. Burmeister, E. J. Hilary and F. M. McEmery for the La Fayette County Telephone Company, capital stock, $50,000.

CAZENOVIA, WIS.—The Cazenovia Telephone Company has been incorporated with a capital stock of $1,000 by A. Rego, Peter Milford, John Keller and John Murray.

NEW FRANKEN, WIS.—The New Franken Telephone Company has been incorporated by A. L. Grieling, W. A. Grieling and Emil A. Weber with a capital stock of $5,000.

CLAYTON, WIS.—Gustafson Paulson, Ernie Muelhausen and Theodore Erickson have incorporated the Clayton Rural Telephone Company with a capital stock of $5,000.

CAMERON, WIS.—The Cameron Farmers' Telephone Company has been incorporated by Charles Lindquist and others; capital stock, $5,700.

LUXEMBURG, WIS.—The Pilsen Telephone Company has been incorporated by John Jisa, Joseph Kulpanek and Thomas Stodola; capital stock $25,000.

WILSON, WIS.—The Wilson Telephone Company has been incorporated by Frank Freihammer, Peter Knemmet and C. Roehrborn; capital stock $4,000.

FINANCIAL ITEMS.

WILMINGTON, DEL.—The United States Telephone Herald Company has filed certificates of amendment, increasing its capital stock from $1,000,000 to $5,000,000.

WADDAMS GROVE, ILL.—The Waddams Grove Telephone Company has increased its capital stock from $1,800 to $2,500.

CHILLICOTHE, ILL.—The capital stock of the People's Telephone Company has been increased from $20,000 to $60,000.

MECHANICSBURG, IND.—Notice has been filed of the increase of the capital stock of the Reese Hills Co-operative Telephone Company from $1,000 to $2,000.

JOPLIN, MO.—At a special meeting of the stockholders of the Home Telephone Company the officers of the company were authorized to increase the capital stock from $750,000 to $1,500,000. This increase is said to be in preparation for taking over the Bell company in this section.

WISNER, NEB.—The Cuming County Independent Telephone Company will issue $2,550 new stock, the same to be used for the purchase of the Eastern Nebraska Telephone Company.

WELLINGTON, O.—The Wellington Telephone Company has petitioned the Public Service Commission for permission to issue $3,500 additional common stock.

GENEVA, O.—The public service commission granted the People's Telephone Company permission to issue $8,000 in common stock, and also extended authority to several other companies throughout the state to make connections and interchange service.

SARANAC, N. Y.—The Mountain Home Telephone Company has applied to the Public Service Commission for authority to issue $623,000 additional stock and $2,000,000 mortgage bonds.

LANSING, MICH.—A proposition has been laid before the state railroad commission whereby the United Home Telephone Company of Ludington and the Citizens' Telephone Company of Muskegon be merged and permission is asked to issue stock to cover the organization. The Ludington company asks to be permitted to increase its present stock from $300,000 to $500,000, selling $100,000 each of preferred and common. The proposed merger will give connection to 5,205 telephones.

NEW HOLLAND, PA.—The Enterprise Telephone and Telegraph Company has increased its bond issue to the extent of $25,000.

WINTERS, TEX.—The Independent Telephone and Telegraph Company will increase its capital stock from $15,000 to $50,000.

RED GRANITE, WIS.—The capital stock of the Red Granite Telephone Company has been increased from $4,000 to $7,000.

TISCH MILLS, WIS.—The County Line Telephone Company has doubled its capital stock, increasing it from $5,000 to $10,000.

THERESA, WIS.—The Theresa Union Telephone Company has increased its capital stock from $22,500 to $50,000.